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'*Knowledge is proud that he has learned so much,*
Wisdom is humble that he knows no more.'—COWPER.

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The Teacher's Health.

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SLEEP—(*continued.*)

The repair of the brain can only go on during sleep. The rest which allows of repair in the heart is obtained between each beat; but the rest to the brain is only established when the mind and thought are completely dormant. There is an old proverb which has some truth for its basis, viz., that as to the necessity for sleep, it is six hours for a man, seven for a woman, and eight for a fool. The young child requires more sleep than an adult, and will be all the better for ten or twelve hours; which seems to indicate that more time is required for the growth of brain-matter than for its renovation.

Sleep is as much a necessity of life as food; it must be indulged in, for there is a production of material during wakefulness which kills, if time is not allowed for its removal. This can only take place during sleep; and hence the necessity for a regular habit. An average duration of six hours in a solid block is sufficient sleep for the active mind, but probably when conjoined with real muscular fatigue, a longer period is required. There are many plans adopted by the sleepless to induce sleep: a mother soothes her child by a simple ditty; a listener to some monotonous drone is likewise lulled to sleep; soft music entices the eyelids to close in slumber, and to some persons a perfect stillness, so far from provoking sleep, leads to wakefulness. It is not at all an unusual thing for an invalid to be read to sleep, but the monotony of sound must be aimless and profitless if it be successful. Muscular exercises, pure air, and a moderate amount of food at regular intervals, with an honest and unsuspicious mind, will be the best sedatives that any one can take; we must avoid narcotics as we ought to avoid all poisons, if we wish to be healthy, and then that common accompaniment of sleeplessness, to which brain workers are especially liable, viz., headache, will not arise.

Headache: its causes are fourfold.

(1) Fulness of habit (Plethora or Hyperæmia).
(2) Defective supply of blood or Excessive loss (Anæmia).
(3) Impure quality of blood.
(4) Presence of morbid effusions or some structural change, the consequence of either of the preceding.

Headache from *Fulness of blood* or *Plethora.*—This condition may arise from luxury, muscular idleness, or from an excessive quantity of food, from ligatures, as tight stays, collars, or other articles of dress, or from the non-removal of excreta, by which a pressure on the veins of the body is brought about, and a greater quantity of blood is thrown into the cerebral sinuses than they can bear with impunity. The remedies are continuous exercise, abstinence from stimulating food, and water only for drinking purposes, avoiding all those nitrogenous foods which tend to produce too much flesh.

Anæmic Headaches.—This class is a common one among teachers; often produced by too long hours of study in a foul atmosphere, or by losses of blood, from piles, etc., excessive use of aperient medicine, sexual excesses, and improper diet. These are the first causes in most instances. Whatever tends to interfere with the regular circulation, and produces local congestions, will promote the conditions which give rise to anæmic headache. The excitements consequent upon the success or failure of the children to come up to the standard in the examination; anxiety about private affairs; undertaking too much work, so as to deprive the teacher of the time required to masticate his food properly and obtain the necessary supply of sleep; all these tend to produce poverty of blood, or to lead to hæmorrhages which the teacher cannot bear. This applies especially to women at certain times.

It is impossible to cure these kinds of headache until the cause is removed. Without that as a first step, quinine, and iron, and similar tonics, which under other circumstances may be extremely beneficial, are simply worse than useless.

The true principle of cure is to equalise the circulation; especially by promoting the progress of the blood through the feet, so that the latter may not be cold. If they are so, immediate measures should be taken to warm them. If the forehead is cold when the headache is severe, a cup of hot tea will be serviceable if the skin is dry; if it is moist, coffee will be better. If the head is hot and the feet cold, the irregularity must

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be overcome and the temperature equalized before it is possible to remove the headache. To attempt mental work whilst such a headache lasts increases the mischief, for it is adding to a *débris* which is already excessive. Neuralgic headache, brow ague, as it is sometimes called, is associated with this class, though it is more frequently connected with errors of diet and stomach derangements, or with miasms, which have altered the quality of the blood. This is especially so with the class which is called Megrims. Alcoholic drinks increase the tendency to this class of disorder without the least possibility of curing them. They give relief to the acute pain in consequence of the same conditions being set up which render a drunken man insensible to the effects of an injury, but as soon as the narcotic effect of the stimulant has passed away, the pain becomes still more severe. We may depend upon it that there are true physiological reasons why alcoholic stimulants cannot cure headaches. I would especially warn women of the danger they run when they fly to such remedies for the distressing pain which they have sometimes to endure. Have patience with it, get the circulation established equally all over the body by outside warmth, by friction, by hot unstimulating drinks; be careful as to the food taken, and get all the pure air to breathe that can be got; the pain will subside in time, and not be increased on the next onset by dangerous remedies.

Headaches from impure blood are those which arise at the beginning of fevers and other acute diseases—they are produced by blood-poisons, as they are sometimes called. They necessarily bring a stop to the teacher's work; there is a class which are caused by miasms, such as the marsh miasm and other agents at present unknown, which bring about brow ague, megrims, and neuralgia of various kinds, in which there is no continuance of fever, and the teacher is able to do some of his duties during the time he is suffering. A damp basement, with the emanations arising from the bodies of children in a crowded ill-ventilated school-room, especially if their clothes have been wetted by a sudden shower of rain at the time of assembly, will frequently produce this class of headache in an anæmic teacher. There is no remedy for this, unless the cause is removed, which, if done, will be rapidly followed by relief, and no medicine will then be really required. The teacher who is subject to headache should not rest until its cause is unravelled. Perhaps it is due to a lithic acid diathesis, or a gouty state of blood; an examination of the urinary secretion will assist to prove this. If that secretion be high-coloured, if it throws down a deposit of red grains, looking like sand, or an ochreous cloud, especially if the tongue is foul, there is probably gout, and certainly indigestion. The quantity of food must be limited; the quality changed to a milk diet, with but little nitrogenous or meat food, and no stimulants. Perhaps the condition may be connected with the lactic acid or rheumatic temperament, in which case the skin must be especially cared for, and those foods which are liable to take on the lactic fermentation, such as pastry, should be carefully avoided. The intestinal canal must be cleared if any offending matters are present, and although it is nasty, there is no remedy equal to a dose of Gregory's powder in the morning (especially if there be a sour taste in the mouth), or a dessert-spoonful of castor oil at bedtime. If the urine be loaded with lithates, it may be right to take an alkaline water, such as lithia-water or potass-water, in a fair quantity every day until the evidence of defective washing is removed. When there is obstinate constipations, the habit of trying to persuade the lower bowel to empty itself at a particular hour every day must be formed, and all irritating purgatives put aside. Purgatives are like alcoholic stimulants; they are absolutely necessary sometimes as helps to get over a present difficulty, but if that difficulty is a daily recurring one, there is a fault somewhere which should be removed, and then the necessity for a purgative will pass away. Indeed, the daily use of purges, by preventing the bowel from having a natural relief, is itself keeping up the constipation. The bowels get like to a donkey which won't go until it is beaten, because it has been so accustomed to wait for the stroke, that it does not understand any other order. Bowels, like donkeys, may be made to go without the whip if their owners have but a few grains of *common sense* in their constitution.

Headaches consequent upon disease already established.

Sick-headaches, sometimes called bilious, are connected with digestion and its derangements; they may be induced by fatigue or excitement, or be the result of last night's debauch, or the sequence of a heavy supper, or of any other meal which is in excess of the requirements of the system. They are indicative of structural change somewhere, and the victim is on the high-road to the establishment of organic disease, either in the liver, as fatty liver, or sour inflammatory condition, which will ultimately lead to wasting of the organ, or to some brain or kidney mischief. I can only repeat, go to the cause, and remove it unhesitatingly, if you want to recover your health. To trust to medicine, and continue to endure the cause, because you like it, is not a course which a teacher should follow. The liver is often blamed for producing a set of symptoms, because it is a link in the chain, but it is only one link of several others.

Nervous headaches are sometimes the sequence of anæmia simply, such as those which arise after the immediate and excessive loss of blood. These may generally be relieved by a proper course of steel; others are connected with a commencing degeneration in the membrane lining the delicate vessels which supply the brain tissue, and which degeneration is called atheroma (or fatty degeneration). The minute vessels have lost their elasticity, and cannot dilate and contract as they ought to do with every pulsation of the heart. The result of this loss of tension is that either the supply of blood to the brain-cells is defective, or there is a loitering on the way of the blood corpuscles, which is not consistent with the work they have to perform, and, as a consequence, the products of brain-cell work are not all dissolved and carried away by the veins as they ought to be. There is severe pain in some part of the head. There is often great intolerance of light and sound. There is a frowning appearance, and an irritability of temper which is out of place in the teacher. When these symptoms arise a long rest from brain work is absolutely necessary, with exercise of a continuous and regular kind in the open air, and a course of diet which shall tend to diminish the presence of fatty matter in the blood, and remove that foggy state which has arisen from its want of proper purification.

Congestive Headaches are often connected with disease

of the heart, tending rather to dulness and inactivity than to restlessness and irritability, though the latter may be present if the brain tissue is damaged. These cases are liable to end with apoplexy from a ruptured vessel in the tissue of the brain itself. When these headaches arise, the duty of the teacher ought to be suspended, and he should retire from office, for it is quite impossible to remove the cause whilst school duties are attended to.

There are numerous sources of headache besides those to which attention has been directed, but there is scarcely one which may not be brought into alliance more or less with the conditions which have been referred to, those which result from direct violence excepted; but it is, of course, quite impossible in the space at my disposal to do more than give general directions as to treatment. The whole may be summed up in the instructions conveyed in the rule that the cause must be found out, and being abated, the treatment must be in accordance with common sense, if it is to be effective, and all empirical plans and treatment by guesswork are more likely to be injurious than beneficial.

(To be continued.)

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How I Teach Latin.

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(Concluded from page 132.)

HAVING shown how boys ought to build up their schemes of Etymology, how to arrange and epitomize the more general rules of Syntax, and, thirdly, how to attack a sentence, to be translated into English, we still have two subjects left to treat of; which I propose to do in this the last section of my essay.

The first of these is the question of Latin composition, either original or otherwise. Two or three hundred years ago many writers, of different nations, used Latin as their language of composition in writing on divinity, surgery, law, and other subjects; and the majority of such Latin was by no means as good as it might have been, nor probably as good as it would be if written by some of our better scholars, at the present time. This fact implies no doubt two facts, first, that there were far fewer readers in those days than in ours; and, secondly, that the readers in those days were far more accustomed to read Latin, for information's sake, than we are. No one, who has read sermons of the later Tudor and even early Stewart periods, can but have been struck with the constant quotations from the Latin authors, given in their original form, found in nearly all preachers' compositions. Whether they were understood by the people, or whether the unreading public went to hear sermons preached in churches at all, is I fancy a question that cannot fully be answered; but it would be a very patient and admiring congregation, in these modern times, that would listen to so much Latin, and return to the next discourse by the same preacher. True, the House of Commons or of Lords will put up with a few, very few, lines of Latin from one of their great orators from time to time—those who do not understand them respectfully smiling—but such experiments must not be too often repeated, or the House's most eloquent orator might be laughed down or "counted out."

I have heard a Latin quotation in a sermon in a college chapel, when all, except perhaps the choristers and the master's ladies, were supposed to know Latin, audibly tittered at; and not many years ago the *Times'* reporter, in giving an account of the distribution of honorary degrees at one of the Universities, noticed that it required two or three long superlatives coupled with some grand 'I' nouns in the dative or ablative plural, given forth, in *ore rotundissimo*, by the public orator to produce a cheer from the undergraduates—so little were they able to follow the meaning of that which they had never received by their eyes and were hearing for the first time.

All this shows that Latin has practically, with one exception, ceased to be a language used by moderns for imparting information. The exception I refer to, is the habit still in use in Germany of writing Latin commentaries on the Latin and Greek authors. The reason of this is plain, for by far the largest section of the Latin-studying world are English, and not German, speakers, more than half of which, probably, do not understand the German language. If an Englishman write a commentary on a Latin or a Greek author, he can hope to obtain a sufficient number of readers, of English speakers, to repay him for his trouble, and lets the Germans, if they care—which I fear, with one or two notable exceptions, they very seldom do—make a translation of his comments for the non-English speakers amongst their own students. Before finishing this part of my subject I may mention in passing, that though published modern Greek treatises by western authors are very rare, there are professors and others who are so imbued with the value of especial, almost untranslateable, terms in the Greek language, to express the ideas they wish to write about, that they find it easier to write their lectures, philosophical discussions, and even sermons, in Greek, and then translate them or, may be, get some other scholar to translate them for them into classical English.

I said, at the outset of these remarks, that much of the Latin written for its own sake some two or three hundred years ago was not as classical as it would have been had it been written now. Within a few weeks one of our most distinguished bishops and scholars said that he believed that we were in the very zenith of classical knowledge and critical power, for we certainly knew more than was known 200 years ago, and that the present call for instruction in lieu of education, would gradually decrease the number and lessen the acumen of future scholars.

To write good Latin prose, one must study the best authors. No amount of exercises, containing only short sentences, will ever teach one to write Latin. To reproduce Cicero or Livy, one had far better try to retranslate an English version of Cicero or Livy, and then compare our efforts with the language found there. By so doing you will soon find the Anglicisms you have reproduced into Latin. A bald translation,—every participle translated as such, every conjunction by some corresponding English conjunction, even idioms turned into literal English,—learnt by heart, will suggest to one when writing Latin much Latinity that might otherwise escape his notice. I believe to try and translate a piece of modern English into the style of Johnson or Addison or even Fielding is a most valuable exer-

cise. Of course, young students ought to translate their English, which they have to turn into Latin, first, into Latinized English. This has been very well done by Wilkins in his most useful book on 'Latin Prose.'

A few years ago I had occasion to prepare a clever lad for a matriculation examination in Cicero's essay on 'Old Age.' As there were a great many subjects, and our opportunities of meeting but few, we combined Latin prose with the work of Cicero, and reproduced the whole essay in Latin from a very good translation I happened to have. It was remarkable before he had got through half the essay how my pupil had caught the Latinity of Cicero—assisted, no doubt, by intimacy with the translator's method of treating his different expressions,—and what a thorough knowledge he got of the subject. Almost any prose writer may be treated in the same way, with great advantage, not only for the writing of prose, but also for the more easily grasping the style and even matter of the author. And now for the other and last subject to be treated of in this essay.

When we come to the poets, even from the very first, we must commence with explaining the more common *feet* and *metres*. Of these, for some time, we may confine our attention to two feet only, and as many metres, leaving lyrics and others, with their varied forms and many different feet (about some of which, by the way, the best authors disagree), till the student has a considerable grasp of the lengths of all finals, and even of those syllables which are accidentally long or short. Having learnt what is meant by the feet called 'dactyls' and 'spondees,' I next teach the general rules as to the length of diphthongs and a vowel before two consonants, and before another vowel in the same word, and make my pupils thus mark several Hexameter lines, as far as these general rules will show them how to. Now, if one examines a series of dactyls and spondees, either in a succession of dactyls or spondees, or alternately, one notices that one cannot have a short syllable by itself; that is, either the preceding or succeeding syllable must also be short; this will often enable us to mark a good many syllables which are accidentally short. Again, since there cannot be three short syllables together, if we have two short syllables on either side of another syllable, the length of which we did not know, we can immediately mark it long. Now, after all the syllables have been marked according to these rules, and then the dactyls and spondees, as far as one can, beginning at both ends of the verse, we shall generally have marked all the dactyls and spondees, in the Hexameters given. Hexameters will then be found to be lines with six feet in them, of which the first four may be either spondees or dactyls, the fifth a dactyl, and the last a spondee (of which the final syllable may be short). On examining these lines one will find a break in them, almost always at the same place, viz., after the first syllable of the third foot; this break is called a cæsura, and is found to have a regular place in many of our English metres. There are poems written in the English language in the Hexameter metre, notably 'Miles Standish,' and the even better-known, 'Evangeline,' both by Longfellow; but the metre does not altogether suit the language. At the same time there are one or two remarkable specimens of accidental Hexameters in the English version of the Bible, and having such ringing in one's ears is undoubtedly a help in forming Latin verses of this metre. The example best known, perhaps, is 'Why' do the | hea'then | rage," and the | peo'ple im | a'gine a | vain' thing || ?" which has as grand a roll as any of Homer's or Virgil's best lines. Notice in this line the cæsura after the word 'rage,' marked with a "; also notice that there is no cæsura after the first syllable of the fifth foot.

The next metre to be taught is the Pentameter, which does not really consist of five feet; but of two parts, each containing two feet and a long syllable. Practically, then, there is a cæsura in these lines, exactly corresponding to that in the Hexameters, but with this difference, that in the Hexameter the second half of the verse begins with the last part of a foot, whereas in the Pentameter, it commences with a new foot. The two feet in the second half of this verse must be dactyls, with another cæsura after the second syllable of the second foot, or in other words the last word must be a dissyllable, or the last two syllables, both monosyllables. Verses of this metre, which are, I believe, universally alternated with Hexameters (an arrangement called Elegiacs), have often been tried in English by some of our best writers, but never with any success. Ovid's 'Heroides' are some of the best known Elegiacs in the Latin language, and, doubtless, it is on account of the popularity of these short poems of Ovid, found to be so useful a class-book for younger boys, that the metre has been so popular in this country, as the first arrangement of lines to be learnt by those wishing to become writers of Latin verse. Till within a few years, every public-school-boy in the kingdom had to try to make more or less of these pairs of verses (vulgarly called 'longs and shorts'), two or three times a week, from the very commencement of his career. It was not for some time that he was allowed to try his hand on a copy of Hexameters (without their attendant Pentameters)—requiring no doubt, more poetic feeling, and an older way of looking at what was to be expressed—and the more difficult metres.

Of these more difficult metres I have no space here to enlarge, suffice it to say, that I strongly recommend the learning by heart some English model of every method of versification to be attempted, and so form the Latin verses from the sound of this English model.

In fine, in learning another language than your own, always let the two languages—your own and the one you are studying—help one another, not only in derivation, but also in syntactical principles and in arrangements of expression. With regard to the former, I quite hope to impress upon all who steadily go through the course of Latin lessons now being given in this paper, the derivations of many hundreds of words of our own language.

With this promise I will conclude the essay, not without the hope that some, who have only even cursorily read it, may be led by what has been said herein,—the result, I may say, of more than twenty-three years of practical teaching and experience—to consider the question as to whether, they had not better perhaps after all, let their lads spend a little more time than they had intended, on so admirable an educational subject as Latin has proved to be.

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Lessons in English.

BY ALEXANDER BAIN, LL.D.

X.—Emotional Qualities of Style.

In this lesson I will advert to one of the vexed questions of Poetry, the presence of the element of Pain, connected with which is the quality named Pathos.

It is well understood that Poetry, like every other Fine Art, exists for heightening the pleasures and diminishing the pains of mankind. Nay, more, its object is *immediate* pleasure; it does not like many other arts give present pain that pleasure may come on some future day. Nevertheless, the subjects chosen by the poet are often unavoidably painful. Hereby arises a clash between the proper ends of the art and the circumstances that are inseparable from its exercise. The upshot is the greatest triumph of the poetry—the redemption or submergence of pain. The instrumentality for this noble purpose is very various. Two points will be here adverted to.

One bears on the quality called Pathos. This is the tender feeling of our nature made use of in assuaging pains that cannot be removed or withheld from us. The tender emotions in their actual exercise are a chief source of human pleasure. They are largely made use of in poetic composition, for the delight they give. By a special provision of our nature they are stimulated by pains, and the pleasure of them may be in excess of the painful occasion; in which circumstances, gratuitous pain may be brought forward with a real advantage; while unavoidable pain is assuaged, or at all events diminished.

The pleasure of Pity is a well-known fact; and its abuse is also known. Indeed, the management of the tender emotion in this bearing is an affair of delicate consideration; and comes to be a subject for emotional criticism.

If the pleasures of the tender or loving emotion were the sole means of assuaging pain, the rule in Art would be, never to introduce pains that could not be more than submerged by the emotional power of Pathos. This is, indeed, a safe rule, and should not lightly be disregarded. Yet there are other poetic resources that may likewise answer the end of overpowering pains. One only will be here noticed; and it is the second of the two points intimated at starting.

The fact is unpalatable, but yet undeniable, that we are constituted so as to take a positive pleasure in the infliction of suffering, and also in seeing it inflicted. Only in the more savage races, and in the most debased minds among civilised men, is the feeling avowed or displayed in its nakedness. The counter-working force of pity, together with the moral education of mankind, keep it down; so that, when indulged, pretexts are usually found that seem to refer the pleasure to some other cause, as revenge or retribution for wrong done, and precautions for our own safety. These are the usual justification of the horrible massacres of war; but they do not suffice to account for the whole extent of our malevolent pleasures. The Greeks were not wanting in pity; but Homer never has an expression of regret for the wholesale slaughter that he has to describe. Virgil so far differs from him as to introduce, into his poem, sympathy for the fallen; illustrating the difference that eight centuries made in the humane sentiments of the two dominant races of antiquity. Modern poets must make an advance even upon Virgil to suit our professions of humanity, if not our actually realised feelings; but it is still apparent that tales of suffering and horror can be tolerated, and even delighted in, by many, without requiring either a submerging pity, or any of the other accompaniments that reconcile us to tragedy. The existence of such a sentiment, even so far as usually admitted (for there is a disposition with some to explain it entirely away), perplexes the criticism of emotional effects, and especially the attempt to judge of legitimate pathos. In fact, we have before us rather a moral than an æsthetic question, when we are dealing with compositions of a highly tragical nature. At all events, it is a question of elevation and refinement of sentiment, how far we should approve of the shocking fatalities introduced by Shakespeare into 'Lear,' 'Macbeth,' 'Hamlet,' and 'Romeo and Juliet,' and by Scott into the 'Bride of Lammermoor,' not to mention the copious literature devoted to the exhibition of crimes and misery at large.

One other preliminary observation will introduce the present lesson. The culminating fact of human misery is death, whether the apprehension of it in ourselves or the spectacle of it in others. All the resources of human genius have been employed in reconciling us to our inevitable doom; and not least the arts of poetry. The emotional quality of Pathos is to be viewed especially as it appears in working out this high design.

In previous lessons we have incidentally brought into notice the interest of the tender emotion generally, the cases being such as to show it in its free scope, without the burden of pain. The examples now to be given will refer to this new and distinct case, as realising the stricter meaning of Pathos.

Readers of the 'Seasons' will not forget the picture of a winter storm, in which a rustic perishes in the attempt to find his own home at nightfall. The poet's power of terse imagery is at its utmost stretch: and works up a tale of horrible circumstance. He passes to and fro between the features of the storm and the emotions of the victim; as if he wished to display the whole force of his consummate art and not to spare the reader's sympathies by a single pang. The

accumulation of circumstances is in the last degree horrible.

> He meets the roughness of the middle waste,
> Far from the track, and blest abode of man;
> While round him night resistless closes fast,
> And every tempest howling o'er his head,
> Renders the savage wilderness more wild.
> Then throng the busy shapes into his mind,
> Of covered pits, unfathomably deep,
> A dire descent! beyond the power of frost;
> Of faithless bogs; of precipices huge,
> Smoothed up with snow; and, what is land, unknown,
> What water, of the still unfrozen spring,
> In the loose marsh or solitary lake,
> Where the fresh fountain from the bottom boils.
> These check his fearful steps; and down he sinks
> Beneath the shelter of the shapeless drift,
> Thinking o'er all the bitterness of death,
> Mixed with the tender anguish nature shoots
> Through the wrung bosom of the dying man,
> His wife, his children, and his friends unseen.

We are no doubt roused to the utmost stretch of pity, but the emotional outburst furnishes us no adequate consolation; the scene passes beyond the power of pity; the effect produced would be more oratorical than poetical; that is, it would inspire us with the wish to render assistance to the dying man, and, that being impossible, it gives us the sinking feeling of misery and despair. The catastrophe is embedded in the pathos of the cottage interior, where wife and children are on the stretch for the return of the hapless wanderer. We may, by courtesy, call this pathos, because it exhibits home affection in its strongest manifestations; but instead of abating, it increases the horrors of the situation.

> In vain for him the officious wife prepares
> The fire fair-blazing, and the vestment warm;
> In vain his little children, peeping out
> Into the mingling storm, demand their sire,
> With tears of artless innocence.

This is a poetic expression of circumstances of tenderness, which we might criticise minutely; but the most salient remark would be that the Latinised style is unfavourable to the full unction of tender feeling. In the actual situation it does little to redeem the closing tragedy:—

> Alas!
> Nor wife nor children more shall he behold;
> Nor friends, nor sacred home. On every nerve
> The deadly Winter seizes; shuts up sense;
> And o'er his inmost vitals creeping cold,
> Lays him along the snows a stiffened corse!
> Stretched out and bleaching in the northern blast.

The elaboration of such a picture with all the arts of style does not diminish the pain of the incident; while the so-called pathos of the domestic bereavement adds to the revulsion that a well-constituted mind feels in the recital of the story. We may indeed admire the poet's art and vigour, even although it heightens our sympathetic misery. But the question arises—Why should a poet choose such a subject at all? The full answer would carry us into the deepest mysteries of Art; only a part of it can be touched in the present connection.

One reason grows out of the choice of subjects for poetry. The phenomena of nature and the incidents of life are, in all ages, part of the materials of the poetic art. These are not necessarily poetical in themselves, but many of them become so by the poet's treatment. Now, if only the agreeable facts of the world and the agreeable incidents of life were selected, we should have an unpleasant feeling of unreality or untruthfulness, which would mar the illusion of art. Some portion of the painful side of things must be admitted in order to obviate this danger; but the concession is not allowed farther than is necessary for the purpose.

The second reason grows out of that fact of our constitution already adverted to, the fascination for suffering. As it is a part of our moral education to subdue this strange emotion, so it is a part of the poet's duty to limit the scope of its gratification.

A third reason is that the tragedy of life gives room for very high effects of style. The grandest compositions extant treat of horrible events. For the sake of those effects, we are disposed to permit such painful scenes as the foregoing to be introduced. The casualties of life are apt to harden us to such incidents; and a poet is not blamed when he founds upon them, provided he does not give us them too often.

These three circumstances permit exceptions to the main condition of poetry, but they do not reverse or abrogate it. Each case must be judged by itself; and the differences of men's minds interfere with absolute decisions.

We have had, in a former lesson, an example from Gray, which was made use of for a minute analysis of poetic forms and expressions. We shall now, in the present connection, make a survey of the famous Elegy, taking note of the topics selected by the poet with a view to soften the shock of death.

With a poem so familiar and accessible, it is unnecessary to quote in full; especially as minute criticism of the language is not the object of view. Three stanzas are introductory, and give the situation and surroundings. The first—

> The curfew tolls the knell of parting day—

introducing us to the circumstances of nightfall in a summer day. The second stanza—

> Now fades the glimmering landscape on the sight

is a farther advance into evening effects: and the third is devoted to a single circumstance, to which the poet would seem to attach special value—

> Save that from yonder ivy-mantled tower
> The moping owl.

Besides being an exquisite example of scenic selection and fine embodiment of circumstances, this introduction contains a favourite thought of poets in dealing with life and death, namely, the comparison to the phases of the day; morning,

noon, and evening—representing the course of life, while night is the counterpart of death. This comparison has a perennial fitness; it never loses its power. It aids in reconciling us to our destiny; and poetry cannot perform a greater office than this. The author of the Elegy, in the view of his task, takes up his position in the shadows of evening, as the appropriate and harmonizing accompaniment; the freshness of morning and the glare of noon would have been equally out of keeping.

The fourth stanza is the churchyard pourtrayed:—

Beneath those rugged elms, that yew-tree's shade,
Where heaves the turf in many a mouldering heap;
Each in his narrow cell for ever laid,
The rude forefathers of the hamlet sleep.

This is highly picturesque; that is to say, it seizes noted and characteristic features, and recalls the aspect of a churchyard as vividly as could be done with so few touches. The two last lines contain the human element, and in them we are to seek for the pathos of the stanza. In one line the eternal and irrevocable doom is indicated; this is in itself humbling and depressing; it draws forth the utmost resources of our self-pity, which, however, although a soothing and consoling influence, is much too small for the occasion. The fourth line shows that the poet's art can do no more that repeat the well-worn but congenial and comforting image of sleep. He helps it out by specialising the human relationship of "fathers"; although, of course, mothers and children are also there.

Two more stanzas are devoted to the mournful finality of our doom; both working by negations. The first—

The busy call of incense breathing morn—
The swallow twittering, from the straw-built shed,
The cock's shrill clarion, or the echoing horn,
No more shall rouse them from their lowly bed—

works by a selection of stirring out-of-door incidents, exhilarating to the living, but lost to the dwellers in the grave; it is meant for enhancing the value of life to those of us that are still in possession. The other is the fine domestic interior, with its appeal to the tender feelings of the ideal peasant's family:—

For them no more the blazing hearth shall burn—
Or busy housewife ply her evening care:
No children run to lisp their sire's return,
Or climb his knees the envied kiss to share.

The next stanza is the poetic rendering of the peasant's daily avocations: it may be called the poetry of labour, the joyous side being predominant:—

How jocund did they drive their team afield;
How bowed the woods beneath their sturdy stroke.

We have not yet forgotten the complement of this in the first stanza—

The ploughman homeward plods his weary way.

These three stanzas, while seeming to deplore the privations of the dead, have the effect of increasing the interest of life to the living: and it is from this circumstance that we must derive any consolation that they can give us in the prospect of death. No doubt, in a rational view, death is mitigated by the sense of the fulness of life, while actually possessed.

Stanzas 8—11 take a new departure—

Let not Ambition mock their useful toil.

And again—

The boast of heraldry, the pomp of power—
And all that beauty, all that wealth e'er gave,
Await alike the inevitable hour;
The paths of glory lead but to the grave.

Allowing for the fine poetical expression at every point, which we are not here considering, the question is as to the emotional value of the thoughts expressed. The main idea is to reprove and humiliate the great, the proud, the wealthy, by dwelling on the worthlessness of all their advantages in coping with death. This may be quite right in the view of their admonition; but what does it do for the rest of us? Nothing apparently, except to come home to that feeling of satisfaction at seeing some of our fellow-men thrown down and mortified. We can always take a certain pleasure in this circumstance, if we are only supplied with a plausible pretext or justification, as in the present instance.

While on the look-out for topics to reconcile us to our last end, we can accept such a reflection as contributing a portion of the desired solace. There is, however, nothing in it to exemplify the quality of pathos, which is understood to be the most suitable accompaniment of thoughts of death.

The stanzas that come next, 12—19, are perhaps, in point of expression, the noblest in the poem. The poet's reflections turn to the possibilities of undeveloped genius among the village host interred around where he stands. The supposition is a little stretched, from the narrowness of the area; but it is within poetical licence. The general strain of the stanzas yields two effects. One is the picturing of lofty genius in several walks, especially government and art. This eulogy of grand human qualities reaches to the highest sublime, when suitably handled. It is not the nature sublime, where simple physical power assumes inordinate dimensions; it is the sublime of humanity which also thrills us with the exaltation of might. In Hampden and in Cromwell the poet depicts the moral sublime, which is perhaps the most effective form of the quality.

With these pictures of exalted humanity is mixed a species of pathos. Our pity is called into play by the want of means and opportunities of the villagers of genius; and the pathos is enhanced in its poetic force, by the beautiful stanza,

Full many a gem of purest ray serene.

This is the utmost that we can expect from a poet; a situation that naturally inspires our pity, without circumstances of tragic horror and revulsion, is heightened and adorned in its most genial aspect, by the resources of poetical comparison, and by everything that makes up the charm of language.

Another thought is raised into prominence, and finely managed. In the sublime of humanity, we may have great powers wrongly applied. Unfortunately, our minds are too apt to be more fascinated with the malign employment of great ability, than repelled by the suffering inflicted. The poet takes advantage of this, while restoring the balance morally by the reflection that these obscure villagers were withheld from such a destiny. He then gives us (19) the fine ideal of the secluded life of the rustic:

> Along the cool sequestered vale of life
> They kept the noiseless tenour of their way.

The next two stanzas exemplify real pathos in reference to the humble monuments erected to keep up the memory of the dead. Still higher in poetic flight are the two succeeding, 22, 23:

> For who to dumb forgetfulness a prey.

The pathos here consists in giving poetic voice to the wail over the loss of life's interests, whatever these may be worth. It does not reconcile us to death, nor provide any kind of compensation, but, on the contrary, would seem at first sight to deepen our sense of loss. In reality, however, it has a certain value, like the outburst of tears in affliction; it gives vent to the feelings, and, by a noble embodiment, adds to the comfort afforded by the lamentation.

The remaining nine stanzas of the Elegy draw a fancy picture of the personality and fate of the supposed author of what goes before. It is a fine sketch of an eccentric genius, interesting by the simplicity of his character, humble position, melancholy temperament, and amiable virtues. This peculiar line of interest is not at present under our consideration. Reverting to the Elegy, as a whole, we should say that the pathos of death, in the form of working upon our tender emotions as a source of comfort in the sad prospect, is not what the poet aims at producing. He chooses the occasion for a variety of reflections on the subject of life and death; and expends his genius on the topic of the inequality of men's condition. We must look to other compositions for the sustained pathos of death; for example, the *In Memoriam* of Tennyson. Even in that notable poem, we have chiefly a protracted, many-toned wail, with whatever comfort may thence arise. How to bear ourselves in the view of the inevitable hour, is a question where religion, poetry, and philosophy, each come into play, and sometimes with conflicting suggestions. Tennyson expends much of his poetical strength in the conflict with scepticism, which does not enhance the poetry. Among the most genuinely poetical aids are those derived from expanding the similitudes of sleep, rest, and the end of trouble; from depicting the affectionate memory of survivors; from the sense of having done our work well; and from our having fairly shared with our fellow-mortals what life has to give. The wail or lament is not forbidden, but it has a tone of effeminacy, in keeping with the weaker, rather than the stronger natures.

The difficulties in the way of pathos may perhaps come up again, before our series is finished. There needs, however, a lesson to be devoted to the emotional handling of character.

(To be continued.)

—o—

The New Class-Subject, 'Elementary Science.'

(What to teach, and how to teach it.)

BY RICHARD BALCHIN.

I PROPOSE in this article to continue the subject-matter of the short, easy, conversational lessons to the first standard. A detailed syllabus of these appears in the February issue of this magazine. Following the lesson upon 'The Stones of the Streets' we have:—

PART II.

(*b*) 1.—LIGHTING THE STREETS: GAS.

(Objects exhibited: Fragments of coal and a tobacco pipe. Picture of gas factory.)

Natural light: the sun. Artificial lights: gas, candles, lamps, etc. The coal flame in the fire is the burning gas, from coal. If coal be burnt in a shut-up place, we can get the gas without its being in a flame.

Tobacco-pipe experiment. After parting with its gas, coal becomes coke. Other substances obtained, *i.e.*, tar. Explain in a general way from the picture the making of gas on a large scale.

(*b*) 2.—CANDLES AND LAMPS.

(Objects exhibited: Candle, lamp with wick; flask, with pointed glass tube fitted; spirit lamp.)

Candles and lamps consist of fat or oil, etc., and a wick. In the case of a candle, the fat melts, passes up the wick, is burnt to a gas, and the gas inflames. Prove this by lighting the 'smoke' from a smouldering wick, *i.e.*, the *fat* is like the *coal*. In the case of lamps, the oil passes up the wick, is burnt to a gas, and the gas inflames, *i.e.*, *oil* is like the *coal*. Prove this by boiling some oil or spirit in a flask over a spirit lamp, and allowing the oil-gas to escape through a pointed glass tube, the oil-gas will inflame.

(*c*) 1.—CARRIAGES.

(Objects exhibited: Pictures of various forms of conveyances in other countries.)

Carry on a conversation about the pictures exhibited. Get the boys to say all they can about them. Good to be able to get from one place to another quickly.

Why? *Two* things necessary. (1) Good roads. (2) Good vehicles. *Public carriages:* cabs, omnibuses, tramcars. *Private carriages:* broughams, dogcarts, waggonettes. For carriages to travel easily, must get rid of *friction, i.e., rubbing.* Contrivances for this:—(1) Wheels. (2) Smooth and level roads—(*a*) Stone; (*b*) Wood; (*c*) Asphalte; (*d*) Iron rails. Reasons for employing these.

PART III.

(*a*) 1.—BOOKS.

(Objects exhibited: Pictures of rolls, and of monk making a MS. Pieces of vellum or parchment.)

Use of books: to see what other people think, or *have* thought. When there was no paper, people used parts of trees, *i.e.*, bark or leaves.

Volume (=something *rolled* up). Leaves (=of a book). Book (from 'boc,' a beech-tree).

Old books or rolls very *dear* and *rare.* Why? *Then* the mass of the people very ignorant. Did not learn to read—nothing to read. *Now*, books very cheap. Some good, some bad.

(*a*) 2.—PAPER.

(Objects exhibited: Picture of a paper-mill. Specimens of rag and other raw materials. Pulp, size, blue, etc.)

Books *now* made of paper. Paper made from rags, etc. Show piece of old rag, and a piece of writing-paper. Chief operations or processes. (1) Sorting the rags. (2) Cutting into strips; taking off buttons, hooks, hard seams, etc. (3) Tearing or dusting. (4) Boiling in water with lime and soda. (5) Washing. (6) Bleaching. (7) Beating or grinding into a pulp. (8) Pulp spread out, gradually sized and dried by passing over hot rollers; then becomes paper. Blotting-paper not sized. (Can show pulp by wetting and beating up some white blotting-paper.)

(*b*) SLATE AND CHALK.

(Objects exhibited: Specimens of slate (in block) and chalk, with some shells in it. Pictures of slate quarry and chalk pit.)

Carry on a conversation about the pictures. Hold up a block of slate and a block of chalk. Say in what respects they differ.

Slate: a rock, dug out of hills in North Wales, etc. Splits easily into plates. Use in consequence. Easily comes off by rubbing. (Make a mark with slate pencil; try to do the same with piece of wood.) Slate, too hard to wash away. Powder a piece of slate; mix powder with a little water, and so make a little mud or clay. Slate like this clay, at first.

Chalk. Softer than slate. Will wash away. Easily rubs off. Try to mark on blackboard with slate, cannot; with chalk, easy. Chalk will not split into plates. Powder up some chalk, mix with water, and make a white mud. Chalk like this at first, at the bottom of a sea, where the shells got into it. Pour water on to some burnt chalk. Burnt chalk = lime.

(*c*) INK (black).

(Objects exhibited: Gall-nuts, sulphate of iron (copperas), and several test tubes and spirit lamp. Little powdered gum or sugar.)

Ink for writing on paper, because ink is darker in colour than paper. Break up some gall-nuts before the boys, and boil them in water in a large test tube over the spirit-lamp. Dissolve some powdered sulphate of iron in water in a large test tube. Let both settle. Drain off clear liquid into two other test-tubes. Let a boy hold one tube, another boy the other tube, and a third boy hold an empty clean tube. If the two boys pour the clear liquids together into the empty tube we get black ink. Dissolve a little sugar or gum in it and *write* with it.

(*d*) 1.—COAL.

(Objects exhibited. Peat, lignite, and coal; shale with ferns, etc.; portions of roots and stems of trees from the coal strata: picture of coal mine.)

Hold up fragments of coal and chalk; note the difference. Coal, a black rock that will burn. Explain briefly the stages from the original swampy forest—to peat—lignite—coal. Place fragments of coal in the bowl of a large tobacco-pipe, cover the bowl with a cap of clay, and heat it. Light the gas issuing from end of stem. More fully, connect the small end of stem with a short piece of glass tubing, which must dip in some water in a test tube, etc., as explained and illustrated on page 22 of 'Hughes' First Science Reader.' By this experiment we obtain (1) coke, (2) tar, (3) gas, (4) the colours which give aniline and other dyes.

Show picture of coal mine, and carry on a conversation about it.

PART IV.

(*a*) 1.—COMMON WILD FLOWERS.

(Objects exhibited, pictures and specimens of buttercup, daisy, primrose, and bluebell).

In this case I will reproduce the lesson actually given to my first standard; for it might be supposed that to attempt a description of *four* plants in one lesson was far too much. In fact, one of my assistants made the remark that he could not 'crowd it all into one lesson.' But then, I found his intention was to give a somewhat detailed botanical description of these plants; taking the various parts in scientific order, *i.e.*, root, stem, leaves, flowers, seeds. Of course with the little fellows of the First Standard, I should do nothing of the sort, but rather let the children suggest the order of the parts, noting first what to them would be the most striking characteristics of the plant. For the *higher* standards I should treat the question more scientifically.

Here, boys, I have a number of flowers all mixed up together. What is this? Ans.—A daisy. And this? (No answer). Not a boy knows this? Ah! If you lived in the country you would know. What colour is it? Ans.—Blue. Now I will pluck off one of the little flowers and hold it downwards; what does it look like? Ans.—A little bell. Yes, it does; and the plant is called a blue-bell. What is this? Ans.—A buttercup. How do you know that? Ans.—Because it's yellow. Do you know what this is? Ans.—A primrose. How do you know that? Ans.—Because it is yellow. Well, so is the buttercup. Ans.—But the buttercup is quite different. In what respect is it different? Ans.—The leaf is different. Which leaf; the leaf of the flower or blossom, or the leaf of the plant? (A boy): Please, sir, the flower has no leaves. Indeed! Look at the flower of this buttercup; you see I pluck off five small yellow parts of it; are not

these leaves? Ans.—(other boys): Yes, sir. Certainly, Jones, we must call these leaves; they are the leaves of the flower. But you mean the green leaves of the plant are different from those of the primrose; and you are right; they *are* quite different. Very well; now we have four kinds of plants here, all mixed up together. Jones, you come out here and select all the daisies and put them on this slate. Smith, you pick out the bluebells and put them on another slate. Cox, you do the same with the buttercups, and then we shall have left the primroses, which Burt will put on this slate. Now you four boys hold up your slates and let us see what there is to say about the plants.

In the first place, I must tell you that I found all those plants growing wild in or about the woods near Caterham in Surrey, at a place called Kenley. The bluebells were only just coming out in flower, and the primroses were nearly over. The daisies and buttercups were growing in the fields outside the wood.

Now, young master buttercup, come here. Look, boys; how many of those yellow leaves did I say each of these flowers had? Ans.—Five. Just so. But look, there are five other much smaller leaves, outside those; theyare turned back on the stalk. Here, Embery, take this flower bud, the yellow leaves are not quite out; are the very small outside leaves turned back on the stalk? Ans.—No, sir. Where are they? Ans.—They are covering over the yellow ones. Just so, and when the yellow leaves come out, what happens? Ans.—They open and turn back. Now, about a dozen boys take each a buttercup flower and gently pull off the little outside leaves and then the yellows ones. What is left? Ans.—A lot of little stalks. They are all sticking up round something in the middle. (A boy): Please, sir, there's some yellow dust comes off them. Very well, can you count how many of those tiny stalks there are? Answer.—About twenty. (Another boy): There's more than that. Then we will say there are a great many. Pull them all off and tell me what you have left? Ans.—A little round thing with a lot of pips all over it. Now, let us see how many different parts of this blossom we have noticed. There is first, the circle of little leaves which cover up the flower before it comes out. Then second, what have we? Ans.—The five yellow ones. Then third? Ans.—The lot of little stalks with yellow dust. And fourth? Ans.—The round thing with pips.

Let us find out whether the blossom of the primrose has parts like these.

(*Note.*—The lesson is continued in this way, and the flowers of the other plants are compared with that of the buttercup. It will be seen that I use no scientific term at all. The lesson is intended to be merely an exercise of the faculty of observation, and, at the same time, a pleasant half-hour for the children.)

(To be continued.)

Science Notes.

WHICH COLOUR IS MOST SEASONABLE FOR CLOTHING?—The idea which we have always entertained is that black is warmer in winter than any other colour, and that for summer wear white is the coolest. The costumes of Indian nations have especially borne out the idea. Now, however, some controversy has arisen upon the subject. Captain Mayne Reid, arguing against this view, draws attention to the change of colour that comes upon Polar hares and foxes at the approach of winter. Instead of being slate blue as they are in summer, they turn snow white. He claims that this change is with the object of their being more thoroughly protected from the cold. On the other hand he points out that the inhabitants of the Torrid Zone, dark skinned by nature, are much better able to bear the scorching rays of the sun, than is the white man who is born in a colder climate. He says that in his own experience, while campaigning in a tropical country under the hottest of suns, he became aware that a black coat was cooler than a white one, both being of the same weight, texture, and thickness. It seems probable then that we should increase our comfort, and the cheerfulness of our public streets in the dull season of the year, if we abandoned the sombre attire in which we are accustomed to array ourselves under the mistaken idea that we are thereby defending ourselves from cold.

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IMPROVED RAILWAY SIGNALLING BY NIGHT.—The question of Daltonism, or colour blindness, is one which, from the many accidents it has contributed to, must always be an important one in the management of our railways. The inability of an engine-driver to distinguish between a red and a green light is a visual defect more common than has been supposed, and with a view to avoiding disastrous results from its existence where it has not been suspected, a new system of signalling is being introduced. The inventors of it propose to use by night the ordinary day semaphore signal with a modification. Instead of the arms being constructed as they are now, they propose to box them in and to illuminate them, so that their position as in the day, and not their colour will signify whether the line is blocked or clear.

* * * * *

DOMESTIC POISONS.—The National Health Society has appointed a Committee to inquire into the presence of arsenic and other poisonous substances in wall papers, pigments, fabrics, and articles of general domestic use. The Committee is an influential one, including Mr. Ernest Hart, Dr. Lauder Brunton, F.C.S., Mr. Bernard Dyer, F.C.S., and other noted men of science. It appears that in many of the Continental states, restrictions are placed on the manufacture and sale of poisonous colours, and the Committee are about to submit a Bill to our own Legislature to a similar effect. Arsenical poisons lurk to an unexpected extent in the brilliant greens of many of our wall-papers. Some are so highly charged with it that it is easy to recognize its presence by comparatively rough chemical tests.

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THE NEW ELECTRIC RAILWAY IN LONDON.—Considerable interest attaches to the fact that we are likely soon to have practical acquaintance with what many physicists deem the railroad of the future. The new electric railway which is to go from Charing Cross to Waterloo will be, no doubt, the first of many similar ones, and we cannot but live in hope that after a time the sulphurous fumes connected with many of our London lines will be things of the past. The new line will pass under the Thames through iron caissons. Beginning near the north end of Northumberland Avenue, it will pass under the Avenue and the

Victoria Embankment, thence under the Thames, and so by College and Vine Streets to Waterloo Station, where it will be connected with the platforms of the L. and S. W. R. It will be worked by a stationary engine at Waterloo, which will transmit the power to the carriages. These are to run separately, and to start as they are filled. The journey to Charing Cross is to take three and a-half minutes. Probably the line will be open for traffic towards the end of 1884.

* * * * *

PRESERVATION OF MARINE ALGÆ.—Among the difficulties of the botanist in collecting and preserving specimens of the vegetable kingdom, none has been more troublesome than that attending the study of sea-weeds. Their delicate beauty has been always destroyed by the methods that have been used, and though their external form could be preserved, it has never yet been possible to successfully show their structure after preparation. This has been especially the case with delicate Desmids, which, sooner or later, lose their natural appearance. As far as those members of the group that live in salt water are concerned, it is probable that these difficulties are over. From the great natural history centre at Naples we hear of a new method which gives good results, and which will be very welcome therefore to all lovers of these lowly forms. The source of the trouble has been that whatever preservative fluid has been used has always caused the protoplasm of the cells and the contained colouring matter to shrink away from the cell wall, and to assume an amorphous appearance in the centre of the cell. Neither picric acid nor osmic acid has been able to prevent this. Solutions of both these acids in sea-water were lately tried, and at the same time solution of iodine in the same fluid was used. The experimenters also tried for purposes of comparison, solutions of the same three reagents in alcohol and in water. The results obtained were that the last two fluids were unsuitable, and the specimens worthless, but that the sea-water gave good effects. The protoplasm of the cells was more easily injured than the nuclei. Solution of corrosive sublimate in sea-water also worked well, but the iodine yielded the best preparations. The treatment was to allow the algæ to remain for thirty to sixty seconds in sea-water, to which a few drops of saturated solution of iodine had been added, and then to transfer them to alcohol of 50 per cent. strength.

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THE BALFOUR STUDENTSHIP AT CAMBRIDGE.—The first appointment to the studentship in natural science, founded in memory of the late Professor F. M. Balfour, F.R.S., has recently been made. The gentleman who has been selected by the committee is Mr. Caldwell, of Caius College, who was one of the late professor's pupils, and who has, since the fatal accident of last year, assisted in the carrying on of the teaching in the Morphological School founded by Mr. Balfour. The studentship is for the encouragement of research especially in animal morphology. Mr. Caldwell has just undertaken to pay a lengthened visit to Australia, with the object of surveying the features of its natural history. The expedition has been undertaken partly under the auspices of the Royal Society and of the British Association, and will extend over four years at least. Mr. Caldwell is well qualified for the work, having not only had considerable experience in the subject at Cambridge, but having worked for some time at the well-known zoological station at Naples. He has lately been awarded the Shuttleworth scholarship at Caius College.

* * * * *

THE LATE MR. FORBES.—Lovers of zoological science and of natural history exploration have been greatly distressed to receive the sad news of the death from dysentery, of Mr. Forbes, prosector to the Zoological Society. He was engaged at the time of his death on an expedition up the River Niger, in the interests of the Zoological Society. Only twenty-eight years of age at the time of his death, he had already achieved a position of which many an older investigator would be proud. He had a brilliant career at Cambridge, becoming very early a fellow of his college. His writings prove him to have been a careful investigator into the hidden things of his science, and to have possessed great power of observation and of interpretation.

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TELEPHONIC SERVICE IN AUSTRIA.—It is interesting to notice that among the practical applications of the telephone, is its introduction into the Austrian railway service. On some of the secondary railroads there is a regular telephonic communication between the different stations.

Notes on Bacon's Essays.

BY FRANCIS WATT, M.A.

ESSAY XXXIX.—OF CUSTOM AND EDUCATION.

SUBSTANCE.

CUSTOM is the great ruler of human actions, though the force of superstition causes some exception to this rule. A few cases of the exceptions and the rule are noted. Some advice given as to the acquisition of good customs.

infused opinions, opinions instilled into our minds.

after, according.

Machiavel, or Machiavelli, a Florentine statesman (1469-1527). His chief work, called *The Prince*, is a treatise on government. In it many cunning and immoral artifices are recommended to rulers. Hence a Machiavelian policy came to mean a shifting and tortuous policy.

evil favoured, ugly, wicked.

bravery of words, boasting words, bravado. As Bacon elsewhere remarks, 'for a bravery upon this occasion.'

formerly in blood; a trained assassin, Machiavelli thought, superior, for the purposes of murder, to a mere enthusiast.

Friar Clement and Ravillac. Jacques Clement, a Dominican friar, assassinated Henry III. of France in 1589. Henry IV. then ascended the throne, and reigned till 1598, when he fell under the knife of Francis Ravillac.

a Jaureguy nor a Baltazar Gerard. Jean Jaureguy, in March 1582, attempted to slay William the Silent, Prince of Orange, by firing a pistol at him. He succeeded in wounding him, but not fatally. In little more than two years Baltazar Gerard again made the attempt. The prince was mortally hurt by the shot, and died almost immediately.

holdeth still, notwithstanding these exceptions the general rule is true.

engagement of words, fastenings, bonds of words. Observe the two negatives which strengthen, and do not destroy are another, as is our present rule.

superstition is now so well advanced, fanaticism is so great.

men of the first blood, who shed blood for the first time.

votary resolution, determination following on a vow or solemn promise.

equipollent, of equal power or force. (L. *polleo*, I am able).

great words, strong expressions.

engines, from L. *ingenium*, ability, power of contrivance, and hence thing contrived. Here it means a mere machine.

Indians, the Hindoos. Cicero (quoted by Storr) says that there wise men 'laying themselves on the fire, let themselves be burnt without a groan.'

wives, this is the custom of *Suttee*. It was definitely forbidden in India in 1829 by Lord W. Bentinck. Cicero says that the 'wives undergo a trial and examination to determine which was the favourite.' The one chosen received permission to mount the fatal pile.

Sparta, a district in Greece, whose inhabitants were famous warriors, and noted for the strict discipline and austerity of their lives. The boys, Bacon tells us, were thrashed in the temple of the goddess Diana without *quecking*, that is flinching or shrinking.

Irish Rebel, supposed to be Brian O'Rourke, executed 1597, but this was near the *end* of Elizabeth's reign (1558-1603).

withe, a willow or osier twig, and hence a rope formed from such.

there be; 'the root *be* was conjugated in the present tense, indicative, as late as Milton's time' (Morris). Cp. 'The Philistines be upon thee;' 'There be that scattereth and yet increaseth;' and many other examples from our English Bible.

engaged, bound fast in. See above *engagement of words*.

put, adduced, stated.

custom is the principal magistrate. Bacon does not clearly distinguish between custom and habit. *Custom* is the repeated doing of certain acts, which impart to us a *habit*. Hence, since we must acquire habits, let them be the best possible.

take the ply, be bent and turned as desired.

to fix, become definitely settled.

copulate and conjoined and collegiate, acting together.

comforteth, strengthens; 'partaking in the aid or comfort of Perkins' (Bacon's 'Henry VII.').

his, its. 'His' is the Old English neuter possessive —it is uniformly used as such in our Bible.

exaltation, an astrological word, meaning ascendant or in power. Storr supposes the concluding reflection to be a side stroke at the weak government of James I., Elizabeth's successor (1603-1625).

ESSAY XL.—OF FORTUNE.

SUBSTANCE.

IT really depends upon a man's self whether he shall be fortunate or unfortunate. Yet outward circumstances help greatly. Fortune seems to depend on a certain quickness or readiness of mind, and also upon a conjunction of small virtues, feeble individually, but strong when united. Some examples from the history of antiquity.

but, here is connective and equals 'that.'

occasion fitting virtue, opportunity given to the capable man.

mould of a man's fortune, the making of his own fortune; so the line, 'man is his own star.'

Faber quis-que, etc. Every one is the architect of his own fortune.

the poet, probably Bacon means Plautus, the Latin comic poet, who has a line substantially, though not literally the same.

serpens, nisi, etc., the serpent does not become a dragon till it has eaten a serpent,—alluding to an old belief.

overt and apparent, open and evident.

certain deliveries of a man's self, certain modes of expression and action.

desemboltura or desemvoltura, quickness, readiness to make the best of an event.

stonds, hindrances.

Cato major, Cato the elder, a Roman writer (234-141 B.C.), known for the rigid severity of his moral maxims.

in illo viro. In that man there was such force of soul that he seemed able to conquer fortune, no matter in what condition he was born. (From Livy, the Roman historian).

falleth upon that, notes the fact that.

versatile ingenium, a versatile genius.

milken way, milky way. Note form of adjective in *en*, we say *wooden*, whilst Spenser has *woody*.

conditions, qualities.

poco di matto, a bit of the fool.

extreme lovers of their country, great patriots; these are not fortunate, unless the veneration of posterity be counted a reward.

hasty, quickly acquired.

Enterpriser and remover. Entreprenant, or *remuant*, adventurer and agitator.

exercised fortune; note the contrast between fortune acquired at once by some happy chance, and that obtained through painful effort.

and it be but, if it were only; *and* is for *an* = if.

to decline, to repress or avoid.

Cæsarem portas, 'Thou carryest Cæsar and his fortune;' so William the Conqueror, in a similar situation, 'Kings do not drown.'

Sylla, or Sulla, who ruled Rome for some time with absolute power; he died B.C. 81. The Fortunate, not the Great.

Timotheus, a famous Athenian general who, after many reverses of fortune, died in exile B.C. 354.

slide, smoothness of melody. Homer is the supposed author of the two great Greek epics, the 'Iliad' and the 'Odyssey.' The first tells of the fall of Troy, the second of the wanderings of Odysseus or Ulysses.

Plutarch wrote the lives of famous Greeks and Romans.

Timoleon, a famous Corinthian general of the fourth century before Christ, fought for the Sicilians against the Carthaginians.

Agesilaus, a contemporary of Timoleon, as King of Sparta, and a noted warrior. Xenophon, the Greek historian, wrote a work on him.

Epaminondas, a Theban patriot, statesman, and general who was killed at Mantinea, B.C. 362.

PLAY.

German Volksleider.
Adapted and arranged by T. CRAMPTON.

Cheerfully.
1st Treble
2nd Treble.
Bass.
1. Haste a - way from books and lore, We will con our tasks no more! Hie a - way to
2. Off to climb the bree - zy hills! O'er the mea-dows bound-ing light, Leap - ing o'er the
Key A. Cheerfully.
1st Treble.
2nd Treble.
Bass.
mirth - ful play, Where na - ture smiles so gay; The birds are war-bling on the spray, And
laugh-ing rills, To gain the pros - pect bright: We'll trace with joy the mos - sy way In
E. t.
let us sing as well as they, As we ram - ble hand in hand, A joy - ous, mer - ry, hap - py band!
woodlands decked with wild-flowers gay. When the birds have ceased to roam We'll chant our lay and seek our home.
Chorus.
Tra la la la, tra la la! Let our songs loud - ly ring! Tra la la la,
Chorus. f. A.
tra la la! Let us gai - ly sing!
Symph.
Symph.

Lessons in Latin.

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KEY TO EXERCISES.

EXERCISE 17.

A.

1. Tarquin built the Temple on the Capitol. 2. So the year had five consuls. 3. After twenty years the Gauls rebelled. 4. Brutus had sworn. 5. Cæsar preserved his life that he might conquer his enemies. 6. Did not the Romans surpass the Tuscans in war in the time of Porsena? 7. But the dignity of the tribunes did not last for long. 8. A bird had (her) nest in a tree. 9. The girl was binding (her) head with (her) hand. 10. Fathers open (their) sons' letters.

B.

1. Leonem gladio verberaverant. 2. Hieme ursi in antro aut in arbore dormiunt. 3. Athenis fidem violaverunt. 4. Milonis tempore hostes urbem oppugnaverunt. 5. Puer et puella contra parentes rebellaverunt. 6. Nemo, præter Cæsarem equum habuit sed quinque equos habuit. 7. Agrum manu aravi ut arator videat. 8. Pecunia puerorum corda delectavit. 9. Lusciniæ vocem in sylva audiverunt. 10. Lusciniæ cantaverunt et saltaverunt lepores.

EXERCISE 18.

A.

1. They were dipping the dog into the river with their hands. 2. They held the horses with reins. 3. In winter the boys were playing in the snow. 4. The farmers did not plough their fields with (their) hands, but the slaves ploughed them. 5. The crow struck the eyes of the Gaul with its wings and talons that he should not see properly. 6. The girls wounded (their) fingers with needles. 7. In winter boys do not swim in the rivers. 8. In the days of Cicero men did not hear the voice of a king. 9. Will you not, O Horace, keep back the horse with (your) hands? 10. Are you not, O master, whipping your pupils with whips?

B.

1. Urbem oppugnaverunt et incolas flagris verberaverunt. 2. Cives urbem habitaverunt, donec hostes igni vastaverunt. 3. Pueri flagris in pratris ludant. 4. In Africa sol calore gramen urit. 5. In Asia ursi et lupi et leones vivunt. 6. Puellæ manus acubus vulneraverunt. 7. O patres, filias flagris non verberabitis. 8. Milites in fossam gladiis telisque pellebant. 9. Sacerdotes floras aræ carpebant. 10. Puellæ matrum voces audiverunt sed non statim responderunt.

LESSON XIX.

SOME PERFECT ROOTS OF SHORT E VERBS.

150. Short E verbs whose roots end in a mute generally form their perfect roots by adding 's' to the present root, and making the proper euphonic (well-sounding) changes.

151. The mutes are thus divided:—

P or lip sounds,	p,	b,	ph (f),	and pt,	which with 's' are written	ps.
K ,, tongue ,,	c,	g,	ch (k),	and x,	,, ,, ,,	x.
T ,, throat ,,	t,	d,	th,	tt,	,, ,, ,,	s.

152. So from the present roots, serp, scrib, duc, reg, mitt, lud, we have for perfect roots, serps, scrips, dux, rex, mis, lus.

153. The perfect root of plectere first becomes plects, then the 't' is thrown away, and the 'cs' is written 'x.' So the perfect root is plex.

154. Many verbs whose roots end in 'd,' as 'defend,' throw away the 's' instead of the 'd,' so the perfect root is 'defend' (same as present), and not 'defens,' but these will all be given in vocabularies thus, P. R. Defend, and of all other short E verbs whose perf. roots are not formed exactly as in 151.

155. The terminations to be added to these perfect roots are the same as those added to other verbs. See par. 140.

156. VOCABULARY 19.

English.	*Latin.*		*Derivative.*
To creep	Serpĕre	R. Serp	Serpent
Before	Antea, conj.		
Seven	Septem (indeclinable)		Septennial
Then / Next	Deinde, conj.	('Ei,' sometimes a diphthong	
Chief command / Power	Impĕrium	G. Imperii, n.g.	Imperial
Only	Tantŭm, adverb		
Snake	Anguis	G. Anguis, c.g.	
To ask for	Rŏgare	R. Rog	Rogation
Army	Exercĭtus	G. Exercitŭs	
Senate	Sĕnātus	G. Senatŭs	Senator
Spain	Hispānia	G. Hispaniæ	
To come	Vĕnīre	P. R. Vēn	Advent
Legion	Lĕgio	G. Legionis	
Romulus	Rōmŭlus	G. Romuli	

157. EXERCISE 19.

A.

1. Ursus (17) in arborem (1) serpsit. 2. Puellæ (8) manibus (8) epistolas scripserunt (4). 3. Dux (2) exercitum duxit (9) et urbem (7) oppugnavit (17). 4. Septem reges (8) in urbe regnaverunt (4) et deinde consules (17) imperium habuerunt (7). 5. Miserunt (5) epistolas (7) ad (10) senatum et pacem (9) rogaverunt. 6. Pueri (7) in horto (8) luserunt (12) sed puellæ (8) hieme (16) tantum in domo (1) luserunt. 7. Gladiis (16) telisque (16) milites (6) (acc. case) pellebant (10). 8. Epistolam (7) scripserit (4). 9. Nonne regnaveras (4) antea ad Hispaniam veneram? 10. Pueri (7) parentes (11) ament (2).

B.

1. The mother (14) wrote (4) a letter (7) to (her) daughter (7). 2. The snakes crept into the house (1). 3. The boys (7) played (12) in the snow (18) in the winter (16). 4. Cæsar (10) had sent (5) a legion to Africa (10) that they might kill (4) the inhabitants (18). 5. Romulus ruled (4) the Romans (10). 6. The king (8) sent (5) a letter (7) to (10) the queen (8) that she might come to (10) Spain. 7. The boy led (9) (his) sister (8) into the meadow (11) without the knowledge of (her) brother (14). 8. We shall have sent (5) the letters (7) to-morrow (15). 9. No one (17) hurt (4) (her) finger (18) with the needles (18). 10. Let them come because they have written (4) letters (7) to (their) masters (13).

LESSON XX.

GENDER OF NOUNS AND ADJECTIVES IN US.

158. All males are masculine, all females feminine.

159. The names of trees are feminine, and 'arbor,' 'a tree,' is exceptionally feminine.

160. Things without life are sometimes masculine and feminine as well as neuter. These are known by their terminations and declension.

161.

All nouns of the A declension are feminine.
Most „ „ O „ masculine,

unless they end in um, when they are neuter.

Nearly all nouns of the U declension are masculine.
All (exc. dies) „ E „ feminine.

The genders of nouns of the I declension will be discussed in future lessons.

162. All exceptions to the above rules will be noticed in the vocabularies.

163. Some adjectives have a separate form when qualifying feminine nouns from what they have when qualifying masculine and neuter nouns. Such adjectives are declined like A nouns in the fem., and like O nouns in the masc. and neut.

164. The neuter forms of adjectives are like the masc. forms, remembering that the voc. and acc. of neuter words are like the nom., and that the nom., voc., and acc., of plural, of all neut. words end in 'a.'

165. SECOND CONCORD.—Adjectives agree with the nouns which they qualify (derived from 'qualis?' 'of what sort?') in gender, number, and case.

166. Just as 'in' is omitted before the names of towns and small islands, so is 'ad,' 'to,' also omitted.

167. VOCABULARY 20.

English.	*Latin.* *m.*	*f.* *n.*		*Derivative.*
Great, Large	Magnus	-na -num	R. Magn	Magnify
Small	Parvus	-va -vum	R. Parv	
Much, Many	Multus	-ta -tum	R. Mult	Multiply
My	Meus, V. Mi	-ea -eum	R. Me	
Thy, Your (sing.)	Tuus	-ua -uum	R. Tu	
His, Her, Its, Their	Suus	-ua -uum	R. Su	
High, Deep	Altus	-ta -tum	R. Alt.	Altitude
Timid	Timĭdus	-da -dum	R. Timid	Timidity
First	Primus	-ma -mum	R. Prim	Primer
Second	Sĕcundus	-da -dum	R. Secund	Secondary
Transmarine, From across the sea	Transmă-rīnus	-na -num	R. Transmarine	
Good	Bŏnus	-na -num	R Bon	Bonus
Safe	Salvus	-va -vum	R. Salv	Salvation
Sabine	Săbīnus	-na -num	R. Sabin	
Roman	Rōmānus	-na -num	R. Roman	
Rome	Rōma		G. Romæ	
To construct	Construĕre		P. R. Construx	Construction
Tree	Arbor		G. Arboris, f. g.	Arbour
To defend	Dēfendĕro		P. R. Defend	Defence
Matron	Mātrōna		G. Matronæ	
As, or As if	Quăsĭ, conj.			
To mourn for	Lūgĕre		P. R. Lux	Lugubrious
Also	Quŏque, conj.			
Almost	Pæne, adverb			Peninsula
Pyrrhus	Pyrrhus		G. Pyrrhi	
Soon	Mox, adverb			
Italy	Itălia		G. Italiæ	
Then	Tum, a conj.; And then, Tumque			
With (together)	Cum, a prep. gov. ab. case			
Name	Nōmen		G. Nominis	Nominal
Obtain to	Obtĭnēre		R. Obtin	
Four	Quātuor (indeclinable)			
Mountain	Mons		G. Montis, m. g. (exc. I)	
Fleet	Classis		G. Classis	Class
Shipwreck	Naufrăgium		G. Naufragii	
To lose	Amittere		R. Amitt	
To join	Adjungere		R. Adjung	Adjunct
Yet, However	Tămen, conj.			
To take	Căpĕre		P. R. Cĕp.	Captive
Territory	Territorium		G. Territorii	Territorial
Again	Itĕrum			Reiterate

EXERCISE 20.

A.

1. Brutum (17) Romanæ Matronæ quasi patrem (14) per annum (17) luxerunt. 2. Secundo quoque anno (17) iterum Tarquinius (17) Romam pæne cepit. 3. Pyrrhus mox ad Italiam vēnit (19) tumque primùm (for the first time) Romani cum transmarino hoste (10) pugnaverunt (10). 4. Pueri (7) alto in monte cum suis sororibus (8) ludebant. 5. Legatum (10) misit (5), bonum virum (18), Ciceronem (1) nomine, ita (17) ut Pyrrhus partem (1) Italiæ obtineret. 6. Horatius (6) primus Romam leones (13) quatuor duxit (9). 7. Brutus (17) bonum filium (7) habuit (7). 8. Consul (17) magnam classem naufragio amisit; exercitum (19) tamen salvum habuit (7). 9. Pugnavit (10) quoque Sabinos et agros (5) urbis (7) territorio adjunxit. 10. Magnum hortum (8) puero (7) monstravit (13).

B.

Remember to express the Latin for 'his,' 'her,' 'its,' 'their,' if not in brackets. See vocabulary.

1. The bird (14) constructed (Eng., built) its nest (14) on a high tree. 2. The great snake (19) crept (19) into the deep ditch (18). 3. The girl (8) was plucking (4) many grapes (7) that she might give (them) to her mother (14). 4. The girls (8) were writing (4) letters (7) with their own hands (8) for their masters (13). 5. He sent (5) a large army (19) to Africa (10). 6. Will you not, my (see vocab.) son (7), come (19) to your mother (14)? 7. He was showing (13) the lion's (13) great body (15) to his daughter (7). 8. The timid kid (9) feared (3) the great wolf (8). 9. Let Cicero (1) come (to) Rome that he may defend Milo (5). 10. He was building a large house (1) in a field (5).

LESSON XXI.

INFINITIVE MOOD, OR VERBAL NOUN.

168. The form printed in the vocabularies as the Latin of a verb is really one of the two nominative cases of the verbal noun, generally called the Present Infinitive.

169. The other nominative case of the verbal noun ends in 'ndum,' and implies 'necessity;' *e.g.*, 'arandum' means 'necessary ploughing,' or 'somebody must plough.'

170. The other nominative case in 're' which appears in the vocabulary simply implies the idea of the verb; *e.g.*, 'Amare est bonum,' 'To love is a good thing.'

171. The form in 're' may have both a direct and an indirect object, but the form in 'ndum' can only have an indirect object. If, therefore, a sentence with the idea of necessity in it has its verb followed by a

direct object, the sentence must be turned into the passive voice.

172. The subject of these forms in 're' is put into the accusative case and always expressed (though we shall not deal with such sentences at present), whilst the subject of forms in 'ndum' is put into the dative.

173. If the subject of a verbal noun in 'ndum' is a personal pronoun it is never expressed, but must be gathered from the context.

174. Thus 'Ambulandum est' means 'Necessary walking is for somebody' (you, or me, or they), but we cannot tell who unless we have some context to help us; *e.g.*, 'Ambulandum est ut montem videamus,' means, 'We must walk to see the mountain,' the 'mus' in 'videamus' showing the person to be understood with 'ambulandum.'

175. The English of 'est' is 'he, she, or it is.' When the subject of a verb (especially 'is') is taken after the verb, the verb is translated by 'there' or 'it,' as 'Est arbor,' 'There is a tree.'

176. The verbal noun ending in 're' (translated 'to—'), as well as that in 'ndum' (translated must—), is of the neuter gender.

177. Translate 'Malum est peccare,' 'It is bad to sin,' or 'To sin is bad,' and 'Filiis non peccandum est,' 'Necessary sinning is not for boys,' or 'Boys must not sin.'

178. VOCABULARY 21.

English.	*Latin.*				*Derivative.*
		m.	*f.*	*n.*	
Human Natural to Man	Hūmānus	-na		-num	R. Human	Humanity
Pleasant Delightful	Jūcundus	-da		-dum	R. Jucund	Jocund
Whilst	Dum, conj.					

EXERCISE 21.

A.

1. Pyrrho (20) laborandum (12) est ut vitam (11) conservet (10). 2. Magnum (20) est laborare (12). 3. Nemini (17) peccandum (3) est. 4. Bruto (17) arandum (2) est ut messem (7) metat (12). 5. Parvum (20) est Gallos (10) superare (17). 6. Humanum est liberos (11) amare (2). 7. Pueris (7) et puellis (8) discendum (6) est. 8. Jucundum est ludere (12) dum sol (10) fulget (16). 9. Rectum (18) vivendum (6) est ut patriam (10) conservemus (10). 10. Bonum (20) est pueros (7) verberare (16) quum (13) dictata (12) non recitabunt (14).

B.

1. The soldiers (6) must work (12) that they may live (6). 2. It is pleasant to teach (3) when (13) boys (7) love (12) to learn (6). 3. The generals (2) must lead (9), and the soldiers (6) must fight (10). 4. It is a great (20) (thing) to keep (10) (one's) word (23). 5. The farmer (7) must plough (12) before (19) he sows (14) his (20) seed (14). 6. It is timid (20) to run (4) when (13) the enemy (10) appears (16). 7. The five (17) men (18) must fight (10) that they may hold (18) the capitol (17). 8. Soldiers (6) must fight (10) with swords (16), and (use que) darts (16) that they may defend (20) their (20) wives (9). 9. It is natural-to-man (21) to drink (14) wine (7). 10. You must run (4) through the city (7) that you may see (18) the spectacle (14).

LESSON XXII.

FIRST PERSONS OF PERFECT TENSE.

179. The Latin for I at end of perfect tense is 'i;' thus 'amavit,' 'he has loved,' gives 'amavi,' 'I have loved.'

180. The Latin for 'we' at end of perfect tense is perfectly regular in 'mus;' thus 'amavimus,' 'we loved, or have loved.'

181. VOCABULARY 22.

English.	*Latin.*				*Derivative.*
		m.	*f.*	*n.*	
Image	Effĭgies				G. Effigiei (E dec.)	Effigy
To see	Vidēre				P. R. Vidi	Vision
Praise	Laus				G. Laudis	Laudable
Since	Quum, conj.					
Latin	Lătīnus	-na		-num	R. Latin	
Tongue Language	Lingua				G. Linguæ	Linguist

182. EXERCISE 22.

A.

1. In aqua (7) vidi effigiem meam (20). 2. Aravi (2) sed mei (20) filii (7) messem (7) metuerunt (12). 3. Altum (20) montem (20) in Africa (10) vidimus. 4. Ad Galliam (16) veni ut milites (6) viderem. 5. Nonne pueros (7) laudavimus (2) quia dictata (12) recitaverunt (14)? 6. Gallos (10) in bello (16) superavi (17). 7. Pueros (7) puellasque (8) docui (3) et laudem obtinui (20). 8. Epistolam (7) ad patrem (14) misi (5) ut meæ (20) sorori (8) librum (6) det (12). 9. Pueros (7) cum (20) libris (6) misi (5). 10. Sol (10) agrum (5) suo (20) calore (18) tepidat (10) ut messem (7) ferat (7).

B.

1. I have sent (5) the boys (7) that they may call (11) their (20) sister (8). 2. We have ploughed (2) the fields (5) that they may produce (7) a harvest (7). 3. We must work (12) because we have (7) children (11). 4. I have not written (4) a letter (7) since I hurt (4) my (20) hand (8). 5. We came to Rome (20) that we might (Eng., to) learn (6) the Latin language. 6. We must walk (3) through the garden (8) that we may dip (8) our (20) hands (8) into the river (5). 7. It is good (20) to keep (10) the laws (5) of (one's) country (10). 8. The boy (7) is teasing (15) his sister (8), therefore I have whipped (16) (Eng., struck) his (20) hand (8). 9. We have said (14) our lessons (12), so (17) let us play (12). 10. I have crept (19) into the ditch (18) that I might save (preserve) (10) my (20) son (7).

LESSON XXIII.

APPOSITION OF LIMITING NOUNS IN THE GENITIVE.

183. When two words in the same sentence refer to the same person or thing they are put into the same case, whether they both be either in the subject or predicate or one in the subject and the other in the predicate; *e.g.*, 'Philippus est rex' (E., Philip is king). 'Urbem Romam oppugnavit' (E., He stormed the city (of) Rome). 'Brutus, consul, Aruntem occidit' (E., Brutus, the consul, killed Aruns). These second nouns are said to be in apposition to the former, and parsed thus:—

Consul | N. | I | is | M. | S. | N. | Appn. to Brutus.

184. If a limiting noun in the predicate do not refer to the same thing as the subject, it is put into the genitive, as 'Cæsaris est hostes vincere' (E., To conquer enemies is Cæsar's), where 'Cæsaris' limits the subject 'hostes vincere,' but is not the same thing, and therefore put into the genitive.

185. This genitive ought to be parsed as limiting the subject, and not as limiting some word understood, as 'part,' 'characteristic,' 'duty,' 'mark,' etc., as used to be taught, though in translating such a sentence into English we must introduce such a word; so, though 'Regis est regnare' may be translated, 'It is the duty of a king to reign,' 'regis' limits regnare, and not 'officium,' or any such word understood.

186. VOCABULARY 23.

English.	*Latin.*		*Derivative.*
To remain	Mănēre	P. R. Mans	Manse
Emperor	Impĕrātor	G. Imperatoris	
Aruns	Aruns	G. Aruntis	
To drive back	Repellere	P. R. Repul	Repulsion
Sometimes	Interdum, adverb		
	m. f. n.		
Founded	Conditus-ta-tum	R. Condit	Condition
Thence	Inde, an adverb		
Shade	Umbra	G. Umbræ	Umbrage
To wash	Lăvāre	P. R. Lav	Lavatory
Four	Quătuor (indeclinable)		Quadrant
Game	Lūdus	G. Ludi	Illusory
Thousand	Mille	Pl. Millia (I decl.)	Mile
Nation	Nātio	G. Nationis	National
To eat	Edĕre	P. R. Ed	Edible
Manlius	Manlius	G. Manlii	
To conquer	Vincĕre	P. R. Vic	Victor
Hamilcar	Hămilcar	G. Hamilcaris	
Word	Fĭdes	G. Fidei (E. decl.)	

187. EXERCISE 23.

A.

1. Puerorum (7) est (par. 175. N.B. This No. will not be repeated) æstate (16) in flumine (5) natare (16). 2. Jucundum (21) est pueris (7) in horto (8) ludere (12). 3. Cæsar (10), imperator, epistolam (7) ad senatum (19) scripsit (4). 4. Puellarum (8) est matribus (14) epistolam (7) scribere (4). 5. Brutus (17), consul (17), Aruntem regis (8) filium (7) sua (20) manu (8) occidit (4). 6. Regis (8) est magnam (20) domum (1) ædificare (17). 7. Bonum (20) est magnos (20) angues (19) occidere (4). 8. Matris (14) est filias (7) docere (3). 9. Humanum (21) est liberos (11) amare (2) et interdum verberare (16). 10. Primo (20) anno (17) post (17) conditam urbem (7) Romulus (19) ad spectaculum (14) ludorum vicinas (14) urbis (7) Romæ (20) nationes invitavit (14).

B.

1. It is pleasant (21) to play (12) in the fields (7). 2. It is the (habit) of boys (7) to swim (16) in the summer (16). 3. Manlius, the consul (17), conquered the general (2) Hamilcar. 4. It is good (20) to keep (10) one's word. 5. The Romans (19) lost (20) twenty (17) ships (9). 6. (We) must remain in Africa (10) until (18) we have conquered the enemy (10). 7. The consul (17) dipped (8) (Eng., sunk) four ships (9) of the enemy (10). 8. It is pleasant (21) to write (4) a letter (7) to one's son (7). 9. It is the (characteristic) of Manlius to conquer his enemies (10). 10. It is natural to man (21) to wash.

LESSON XXIV.

MISCELLANEOUS AND RECAPITULATORY.

188. EXERCISE 24.

A.

1. Æstate (16) pueris (7) natandum (16) est. 2. In Africa (10) jucundum (21) est in umbra (23) jacere (13). 3. Hamilcar (23) cum (20) suis (20) militibus (6) pacem (9) a Romanis (10) rogavit (19). 4. Manlius (23) Africam (10) vastavit (18) et multa (20) millia (23) inde (23) militum (6) duxit (9). 5. Romani (10) tantum (19) quatuor (23) naves (9) amiserunt (20). 6. Sacerdotes (18) floribus (6) aras (18) sparserant (14). 7. Puella (8) caput (11) floribus (6) vinciat (11). 8. Veniam (19) ut hortum (8) videam (3). 9. Rogavit (19) Horatium (6) ut suum (20) hortum (8) aret (3). 10. Hostes (10) Gladiis (16) telisque (16) repulit.

B.

1. The crow (18) struck (17) the Gaul (10) with his talons (18) that he might not (use 'ne' for 'ut non') see (3) Horace (6). 2. Pyrrhus (20) laid waste (18) many (20) nations (23) with sword (16) and (use 'que') fire (13), and (atque) came (19) to Africa (10). 3. We must walk (3) through the city (7) that we may see (3) the spectacle (14). 4. It is a great (20) (thing) to keep (10) one's word (23). 5. It is the (duty) of girls (8) to pluck (4) (Eng., card) the wool (10) for their mothers (14). 6. He is lying (13) on the grass (18) and eating (23) his dinner (15). 7. I saw (3) an image (22) of the lion (13) in the water (7). 8. Let us come (19) to Rome (20) that we may see (3) Cicero (1) the orator (8). 9. He dipped (8) (Eng., sunk) four (23) ships (9) in the war (16) against (17) Hamilcar (23). 10. The peace (9) did not last (17) (Eng., was not lasting).

---

189. EXAMINATION QUESTIONS. No. III.

1. Parse in shortened form, as explained in paragraphs 83, 116, etc., every word of sentence 10 in Ex. 23, A.

2. Mark the long and short vowels, according to rules in paragraphs 132 and 133, in the following lines, and any accidental lengths that have been marked in the vocabularies:—

Quam bene Saturno vivebant rege, priusquam
Tellus in longas est patefacta vias!
Nondum cæruleas pinus contemserat undas
Effusum ventis prælbueratque sinum.
Illo non validus subiit juga tempore taurus:
Non domito frænos ore momordit equus.
Non domus ulla fores habuit; non fixus in agris,
Qui regeret certis finibus arva, lapis.
Ipsæ mella dabant quercus; ultroque ferebant
Obvia securis ubera lactis oves.
Non acies, non ira fuit, non bella; nec enses
Immiti sævus duxerat arte faber.

3. Distinguish carefully between 'Cæsaris est regnare' and 'Cæsari regnandum est.' 4. When is the Latin for 'to' (implying motion) omitted? 5. Explain the term 'limiting genitive.'

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ANSWERS TO

Pupil Teachers' Examination Papers.

FIRST YEAR.

Arithmetic.

Three hours and a half allowed.

MALES.

1. Convert $\frac{5}{8}$ and $\frac{11}{14}$ to decimals, and then divide their difference by their sum to five places of decimals.

$\frac{5}{8} = \frac{\cdot625}{8} = \cdot078125$

$\frac{11}{14} = \frac{\cdot7857}{14)11\cdot0000} = \cdot0784$

sum = ·156525

diff. = ·000275

·156525)·000275000(·00175... Ans.

156525

1184750

1095675

890750

782625

.....

2. Find the value of $2\frac{1}{4}$ of $\frac{7}{9} + 3\frac{1}{2} - 1\frac{5}{8}$ of $\frac{5\frac{5}{8}}{4\frac{1}{2}}$

(*a*) $2\frac{1}{4}$ of $\frac{7}{9} = \frac{9\times7}{4\times8} = \frac{63}{32}$;

(*b*) $\frac{63}{32} + \frac{112}{64} = \frac{238}{64}$.

(*c*) $1\frac{5}{8}$ of $\frac{5\frac{5}{8}}{4\frac{1}{2}} = \frac{13\times35\times5}{8\times7\times6\times24} = \frac{91}{144}$

(*d*) $\frac{238}{64} - \frac{91}{144} = \frac{525-200}{90} = 3\frac{55}{144}$. Ans.

3. If the rent of 168·375 acres be £33·675, find the rent of 75 acres 3 roods.

168·375 ac. : 75·75 ac. :: £33·675 : rent required.

$\frac{£33\cdot675\times75\cdot75}{168\cdot375} = \frac{£75\cdot75}{5} = £15\ 3s.$ Ans.

4. Find the exact value of 17·2$\frac{1}{7}$ yards of calico at 5·13d. per yard.

5·13d. × 17·2$\frac{1}{7}$ = $5\frac{13}{100}$d. × $17\frac{1}{11}$

$= \frac{77\text{d.}\times190}{15\times11}$

$= \frac{266\text{d.}}{3} = 88\frac{2}{3}\text{d.} = 7\text{s. }4\frac{2}{3}\text{d.}$ Ans.

5. Find in furlongs, poles, etc., the value of ·43920$4\frac{1}{5}$ of a mile.

·43920$4\frac{1}{5}$ ml.

8

3·51363 fur.

40

20·54 po.

3 fur. $20\frac{27}{100}$ po. = 3 fur. 20 po. 3 yds. Ans.

FEMALES.

1. Make out the following bill:—99 lb. at 4½d. per lb.; 135 oz. at 2s. 2½d. per oz.; 33¾ lb. at 1s. 4d. per lb.; 360 lb. at 7½d. per lb.; 31½ doz. at 1s. 1d. per oz.; 38¼ yds. at 1s. 6d. per yd.; 22½ doz. at 3 for 2d.

	s.	d.		£	s.	d.
99 lb.	at 0	4½	per lb. =	1	17	1½
135 oz.	,, 2	2½	,, oz. =	14	18	1½
33¾ lb.	,, 1	4	,, lb. =	2	5	0
360 lb.	,, 0	7½	,, ,, =	11	12	6
31½ doz.	,, 1	1	,, oz. =	1	14	1½
38¼ yds.	,, 1	6	,, yd. =	2	17	4½
22½ doz.	,, 3 for 2d.		=	0	15	0
				35	19	3

Ans.

2. Find the cost of 7,059 articles at £144 13s. 10½d. each.

	£	s.	d.
Cost of 7059 at £1 each =	7059	0	0
			12
	84708	0	0
			12
,, ,, £144 ,, =	1016496	0	0
,, ,, 10s. ,, ½ val. at £1 =	3529	10	0
,, ,, 3s. 4d. ,, ⅓ ,, 10s. =	1176	10	0
,, ,, 5d. ,, 1/12 ,, 3s. 4d. =	147	1	3
,, ,, 1½d. ,, ¼ ,, 5d. =	36	15	3½
	£1021385	16	6½

3. 20 sq. yds. 5 sq. ft. 48 sq. in. at £3 8s. $0\frac{3}{4}$d. per sq. yd.

		£	s.	d.
1 sq. yd. cost	=	3	8	$0\frac{3}{4}$
			20	
		68	1	3
3 sq. ft. ,, $\frac{1}{3}$ price of 1 yd.	=	1	2	$8\frac{1}{4}$
$2\frac{1}{4}$,, ,, $\frac{1}{9}$,, ,,	=	0	17	$0\frac{3}{16}$
12 in. ,, $\frac{1}{27}$,, $2\frac{1}{4}$ ft.	=	0	0	$7\frac{13}{16}$
		70	1	7 Ans.

4. Find the greatest common measure of 3555, 4977, 6636.

(a)	(b)		(c)	
2	3555	4977	1	3
	2844	3555		711
	711	1422	2	711
		1422		

237 = G.C.M. of (a) (b) and (c). Ans.

711 = G.C.M. of (a) and (b).

5. Find the difference between $27\frac{3}{11}$ and $12\frac{39}{77}$.

$27\frac{3}{11} = 27\frac{21}{77}$
$12\frac{39}{77} = 12\frac{39}{77}$
$14\frac{82}{77}$. Ans.

Grammar.

1. Parse and analyse the following sentences:—

'Sad was thy lot on mortal stage;
The captive thrush may brook the cage;
The prison'd eagle dies for rage.'

PARSING.

Sad—predic. adj., qual. 'lot.'
was—irreg. intrans. verb, *am, was, been*, indic., past indef., 3rd pers., sing., agr. with 'lot.'
thy—poss. adj. pron., qual. 'lot.'
lot—abstr. noun, neut., sing., nom., subj. of 'was.'
on—prep., gov. obj. case 'stage,' relating 'lot' and 'stage.'
mortal—adj., qual. 'stage.'
stage—com. noun, neut., sing., obj., gov. by 'on.'
the—dist. adj., or def. art., limiting 'thrush.'
captive—adj., qual. 'thrush.'
thrush—com. noun, masc. or fem., sing., nom., subj. of 'may brook.'
may—aux. verb } reg. trans. verb, potential, pres. indef., 3rd pers. sing., agr. with 'thrush.'
brook—infinitive }
the—as before, limiting 'cage.'
cage—com. noun, neut., sing., obj., gov. by 'may brook.'
the—as before, limiting 'eagle.'
prison'd—part. adj., qual. 'eagle.'
eagle—com. noun, masc. or fem., sing., nom., subj. of 'dies.'
dies—reg. intrans. verb, indic., pres. indef., 3rd pers., sing., agr. with 'eagle.'
for—prep., gov. obj. case 'rage,' relating 'dies' and 'rage.'
rage—abstr. noun, neut., sing., obj., gov. by 'for.'

ANALYSIS.

Simple Subject.	Enlargement of Subject.	Predicate.	Object.	Extension.
(1) Lot	thy, on mortal stage	was sad		
(2) The thrush	captive	may brook	the cage	
(3) The eagle	prison'd	dies		for rage

2. What are diminutives and how are they formed. Give instances.

Diminutives are words expressing endearment or contempt. They are also applied to the young of animals and to things below the average size.

Diminutives are formed from other nouns by suffixes; as, maid*en*, satch*el*, cocker*el*, lamb*kin*, duck*ling*, bull*ock*, Ann*ie*.

3. Give the meaning of the following terminations of adjectives in English:—ish, en, fast, fold, less, ly, and an example of each termination.

Termination.	Meaning.	Example.
—ish	'belonging to,' 'having the qualities of'	Romish, whitish
—en	'consisting of,' 'made of'	wooden, golden
—fast	firm	stedfast, rootfast
—fold	times	tenfold, sixtyfold
—less	without	helpless, heedless
—ly	like	manly, sickly

Geography.

1. Explain, as you would to children, these terms belonging to rivers: *Spring, Source, Bed, Bank, Basin, Course, Affluent, Mouth, Estuary;* and illustrate each of them by reference to the River Thames.

A small stream perhaps springs out of the ground away up among the hills, and trickles down towards a valley. The *spring*, if the beginning of a river, is called its *source*. As the river proceeds along the valley it wears a channel, or *bed*, which is bounded on each side by its right and left *banks*. Continuing its *course*—that is, the direction in which it flows—it empties itself by its *mouth*, which, if worthy to be considered an arm of the sea, is called an *estuary*, or firth. During its course it is joined by other streams, called feeders, or *affluents*, and all the land drained by the river and its branches is called its *basin*.

For example, the Thames takes its source in seven small deep springs in the Cotswold Hills, about three miles from Cheltenham. Its basin is bounded by the Cotswold, Edge, Chiltern, and East Anglian Hills on the north, and by the Marlborough Downs, Hampshire Downs, and the Weald on the south. On its left bank lie the counties of Oxford, Buckingham, Middlesex, and Essex, and on its right, Berkshire, Surrey, and Kent. It has four affluents joining it from the north, the Cherwell, Thane, Colne, and Lea; four from the south, Kennett, Wey, Mole, Medway. The Thames has an easterly course, and the estuary at its mouth forms the most splendid natural harbour in the British Islands—an estuary by its form and position destined to become the trading centre of the world.

2. Describe, as fully as you can, the colonies of Victoria and British Columbia.

N.B.—Draw a map in illustration of your answer.

Victoria, situated at the S.E. corner of Australia, is separated from New South Wales by the Murray River, and from Tasmania by the Bas Strait. Its surface is mountainous, except in the N.W., which is a region of great swamps, caused by the overflow of the Murray. This region, however, has excellent pasturage, and was on this account called Australia Felix. Little clearing is required, and the nature of the ground affords every facility for tillage. The climate is more genial to British colonists than that of any other in Australia. The discovery of gold in 1851 attracted emigrants not only from Britain, but from all parts of the world, and Victoria was soon at the head of all the Australian colonies. Its capital is Melbourne; and the other principal towns are Ballarat, Sandhurst, and Geelong.

Under the name of British Columbia is now embraced the whole of British North America, west of the Rocky Mountains, and includes the district of Stickeen, Vancouver Island, and Queen Charlotte Island. All these form one colony, which, in 1871, joined the dominion of Canada. Columbia proper is about four times the size of the British Isles, and the mainland is watered by three fine rivers, the Simpson, the Stickeen, and the Frazer. The colony is to a great extent occupied by two mountain-ranges gradually converging towards the N., where they enclose a vast plain. With the exception of this plain, the interior is extremely mountainous, with vast forests, numerous lakes, and swampy tracts. During the last few years agricultural operations have been greatly extended. The climate is very moist in summer, and extremely cold in winter. New Westminster, the capital, is the only town on the mainland.

History.

1. When did the Romans invade this island? In what condition did they find the inhabitants and how was that condition changed when Britain ceased to be a Roman province?

Julius Cæsar invaded Britain B.C. 55 with two legions, and again in 54 with five legions. After he left the island, without seeing any more than the south-eastern part of it, the Romans made no serious attempt to conquer Britain till the time of Claudius, who came over A.D. 43.

When Julius Cæsar came to Britain the inland parts of the country were thinly peopled by a race of warriors who lived by hunting and by herding cattle, and dwelt in huts of wood or wickerwork; their clothes were made of skin; their bodies stained blue. In the south the people were, from intercourse with Gaul, more civilised. Under the Romans their commerce, which was before inconsiderable, improved immensely, and much progress was made in manufactures of bronze and pottery. Although the Romans had been the cause of much bloodshed, yet they did much to improve the condition of the Britons. They taught them how to dress and arm themselves, made great military roads, built forts, and refined the whole English way of living. The invasion of the Romans introduced government and civilised manners. Great cities grew up, connected by excellent roads. Agriculture throve so much that Britain became one of the chief corn-exporting countries of the Roman Empire. Above all, it was in the Roman time and by means of Romans ships that the Christian religion was first brought into Britain.

2. Explain how we come to be called English.

After the Romans left Britain there came tribes of Jutes, Angles, and Saxons, from the shores of the North Sea. These gradually overcame the ancient Britons and took possession of the land. As the chief tribe was called Angles the country took the name of Angle-land, and hence by degrees it became modified to its present name, England, the inhabitants of which are known as English.

3. How did it happen that the English had any Danish kings? Mention their names and dates.

The frequent incursions of the Danes forced Ethelred the Unready to buy off the invaders with large sums of money, which was raised by a tax called the *Danegeld*. This cowardly policy led the Danes to come in great numbers. The two principal leaders were Sweyn and Thurkill. In 1013 Sweyn sailed up the Trent, rapidly conquered the country, and wrested the kingdom from Ethelred. Early the next year Sweyn died. Ethelred was re-called, but died soon after. The war was kept up between his son Edmund and Sweyn's son Canute. Two rival kings were elected 1016, Edmund holding all south of the Thames, along with East Anglia, Essex, and London; Canute took the rest. By the death of Edmund, in the same year, Canute became king of all England, 1017. He was succeeded by Harold I., 1035, who reigned till 1040, and was succeeded by Hardicanute, who reigned till 1042.

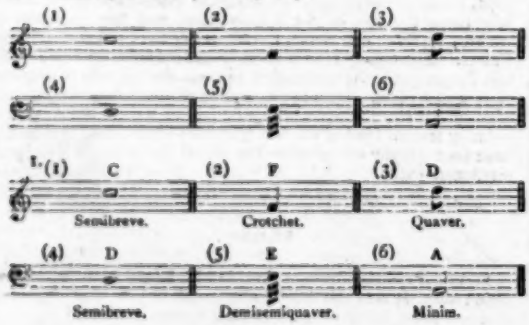
Composition.

Write from memory the substance of this passage:—The best sponges of commerce come from the Archipelago. The finest sponges come from the greatest depths and the other kinds are generally found in shallow waters. When brought up from the bed of the sea the sponge is black and living; it is at once well trodden, until a milky fluid is expelled and the animal is dead. The sponge is then thrown back into the water for eight or ten hours. Afterwards, with repeated washing, squeezing, and bleaching, it takes the yellow or brown colour which it retains.

Music.

A quarter of an hour allowed for this paper.

1. Write (1) above each of the following notes its scale-name (C, or *Do*; D, or *Re*, &c.): and (2) below each of the notes its value-name (semibreve, minim, &c.):



2. Write below each of the following intervals its name (Major third, &c.):

3. Add the proper time-signature to each of the following:

TONIC SOL-FA NOTATION.

1. What is the interval (1) between *me* and *lah*, and (2) between *ray* and *fah*?

1. (1) Perfect 4th. (2) Minor 3rd.

2. Write the pulse-signs for three-pulse measure.

2. Primary form. | : : ‖

3. Write (using two-pulse measure) one note continued through four-pulses.

3. |1 :— |— :— ‖

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed for this Paper.

Arithmetic.

MALES.

1. At what rate per cent. per annum will the simple interest on £128 2s. 6d. amount to £31 14s. 2¼d. in 4½ years?

$$\left.\begin{matrix}£128\tfrac{1}{8} : £100 \\ 4\tfrac{1}{2}\text{ yrs.} : 1\text{ yr.}\end{matrix}\right\} :: £31\ 14s.\ 2\tfrac{1}{4}d. : \text{rate.}$$

$$\frac{£31\ 14s.\ 2\tfrac{1}{4}d. \times 100}{128\tfrac{1}{8} \times 4\tfrac{1}{2}} = \frac{6088\tfrac{5}{4}d.}{8} \times \frac{2}{9} \times \frac{8}{1025}$$

$$= \frac{6765 \times 200}{1025}d.$$

$$= 1320d. = \underline{£5\tfrac{1}{2}}. \quad \text{Ans.}$$

2. Three persons, A, B, and C, sent 55, 70, and 75 sheep respectively to a field of grass the rent of which was £30. What percentage of the rent should each pay?

55+70+75=200

A must pay $\frac{55}{200}$ or $\frac{11}{40}$ of 100 = $\underline{27\tfrac{1}{2}}$ p.c. Ans.

B ,, $\frac{70}{200}$ or $\frac{7}{20}$,, = $\underline{35}$ p.c. Ans.

C ,, the remainder = $\underline{37\tfrac{1}{2}}$ p.c. Ans.

3. A ship depreciates in value each year at the rate of 10 per cent. of its value at the beginning of the year, and its value at the end of three years is £14,580. What was its original value?

At the end of the 1st year the value is $\frac{90}{100}$ or $\frac{9}{10}$ of original value.

,, 2nd ,, $\frac{9}{10}$ of $\frac{9}{10}$,,

,, 3rd ,, $\frac{9}{10}$ of $\frac{9}{10}$ of $\frac{9}{10}$,,

that is $\frac{729}{1000}$ of the prime cost.

∴ the original value = $£\frac{14580 \times 1000}{729} = \underline{£20,000}$. Ans

4. What dividend should I get from investing £1470 in the per cents. at 97½, brokerage being ¼ per cent.?

£98 : £1470 :: £3 : dividend.

$$\frac{£3 \times 1470}{98} = \underline{£45}. \quad \text{Ans.}$$

FEMALES.

1. Simplify—(*a*) $2\frac{1}{2}$ of $1\frac{1}{3}$ of $5\frac{1}{2}$. (*b*) $\frac{1}{2}\frac{1}{3}$ of $2\frac{1}{3}\frac{1}{3}$ of $\frac{1}{1}\frac{1}{1}$.

(*a*) $2\frac{1}{2}$ of $1\frac{1}{3}$ of $5\frac{1}{2} = \frac{7\times11\times11}{3\times6\times2} = 23\frac{11}{12}$. Ans.

(*b*) $\frac{1}{2}\frac{1}{3}$ of $2\frac{1}{3}\frac{1}{3}$ of $\frac{1}{1}\frac{1}{1} = \frac{12\times45\times10}{25\times16\times21} = \frac{9}{14}$. Ans.

2. Express £$\frac{1}{5}$ − $\frac{3}{11}$ crown + $\frac{3}{5}$s. as the fraction of $\frac{4}{11}$ guin. + $4\frac{1}{2}$ florins.

(*a*) £$\frac{1}{5}$ − $\frac{3}{11}$ cr. + $\frac{3}{5}$s. = $\frac{1}{5}\frac{3}{0}$s. − $\frac{1}{1}\frac{3}{0}$s. + $\frac{3}{5}$s.

,, = $2\frac{1}{2}\frac{3}{0}$ − $\frac{3}{5}\frac{3}{0}$

,, = $\frac{1166-90}{99} = 10\frac{7}{9}\frac{6}{9}$s.

(*b*) $\frac{4}{11}$ gui. + $\frac{1}{2}\frac{1}{0}$ fl. = $\frac{4}{11}$s. + $\frac{3}{5}\frac{6}{0}$s.

,, = $\frac{252+286}{33}$

,, = $\frac{1}{3}\frac{0}{3}\frac{8}{3}$s.

(*c*) Fraction required = $\frac{1}{5}\frac{7}{5}\frac{6}{6}$ ÷ $\frac{3}{3}\frac{3}{3}\frac{9}{9}$ = $\frac{1076\times33}{99\times538} = \frac{2}{3}$. Ans.

3. A can do a piece of work in 6 days, B can do it in 8 days, and C in 12; how long would they take to complete it, all working together?

A, B, and C do in 1 day $\frac{1}{6} + \frac{1}{8} + \frac{1}{12}$ of the whole.

,, ,, $\frac{4+3+2}{24}$,,

,, ,, $\frac{9}{24}$,,

∴ they will do the whole in $\frac{24}{9}$ or $2\frac{6}{9}$ days. Ans.

4. Reduce $9\frac{5}{7}$ and $3\frac{1}{1}\frac{2}{3}$ to decimals.

$9\frac{5}{7} = 9.\dot{7}14285\dot{}$. Ans.

$3\frac{1}{1}\frac{2}{3} = 3.2297\dot{}$. Ans.

Grammar.

1. 'Some feelings are to *mortals given*
With less of earth in them than *heaven*;
And if there *be* a human tear
From passion's dross *refined* and clear,
A tear so limpid and so meek
It *would* not *stain* an angel's cheek,
'*Tis* that which pious fathers *shed*
Upon a duteous daughter's head.'

Analyse the adverbial sentences in the above.

Adverbial Sentence.	Connective.	Subject.	Enlargement of Subject.	Predicate.	Object.
(1) Than (there is a little of) heaven (in them).	than	(little)	(of) heaven	(is in them)	
(2) If there be a human tear from passion's dross refined and clear, a tear so limpid and so meek.	if	a tear	human, from passion's dross refined and clear, a tear so limpid and so meek.	be	
(3) (that) it would not stain an angel's cheek.	(that)	it		would not stain	an angel's cheek.

2. Parse the words in italics.

mortals—com. noun, mas. or fem., plur., obj., gov. by 'to.'
given—complete part. of the irreg. trans. verb. give, gave, given, attrib. to 'feelings.'
heaven—com. noun, neut., sing., obj., gov. by (of).
be—irreg. intrans. verb, *am, was, been*, subjunctive, pres. indef., 3rd pers., sing., agr. with 'tear.'
refined—complete part. of the reg. trans. verb 'to refine,' attrib. to 'tear.'
would—aux. verb } reg. trans. verb, potential, past indef.,
stain—pres. infin. } 3rd pers., sing., agr. with 'it.'
it—pers. pron., 3rd pers., referring to 'tear,' sing., neut., nom., subj. of 'is.'
is—irreg. intrans. verb, *am, was, been*, indic. mood, pres. indef. tense, 3 pers., sing., agr. with 'it.'
shed—irreg. intrans. verb, *shed, shed, shed*, indic., pres. indef., 3rd pers., plur., agr. with 'fathers.'

3. Mention all the ways in which the Latin prefix 'ad' becomes modified in composition, giving examples.

Ad is modified in composition into *a, ac, af, ag, al, an, ap, ar, as, at*, as *a*shere, *a*scend, *ac*cede, *af*fect, *ag*gravate, *al*lege, *an*nex, *ap*pend, *ar*biter, *as*sist, *at*tract.

4. Mention some of the terminations of adjectives derived from the Latin.

The following are endings derived from Latin:—*al* in regal, *ary* in necessary, *ent* in fluent, *ile* in fragile, *able* in culpable, *ous* in anxious, *acious* in voracious, *ive* in captive, and *se* in immense.

5. Paraphrase the following passage:—

'Astrophel, England's pride;
O stroke that, when he died
Thrill'd through the realm, our best, our fairest ta'en:
For now the wound accurst
Lights up death's fury thirst;
Yet the allaying cup, in all that pain,
Untouch'd, untasted, he gives o'er
To one who lay, and watched with eyes that craved it more.
"Take it," he said, "'tis thine;
Thy need is more than mine,"
And smiled, as one who looks through death to life;
And then passed, true heart and brave,
Loyal from birth to grave,
Beyond the precincts of earth's idle strife;
Starbright among God's stars above,
All mortal passion still'd in that eternal love.

F. T. PALGRAVE.
The Death of Sir Philip Sidney.

What a wail of grief ran through England when it was known that her most illustrious son, Sir Philip Sidney, had received a mortal wound and died on the field of battle. How hearts thrilled with a mournful joy when it was told that though suffering from the burning thirst which results from loss of blood, yet he unselfishly gave up the draught of water offered to him in favour of a wounded soldier who seemed in his eyes to need it more than himself. After doing this noble deed he smiled as one who was to gain immortality, and then this brave and ever-gallant spirit passed from the battle of life to shine like a star in heaven, where man's rage is quenched in the love of God.

Note.—It may interest some to know that 'Astrophel' is derived in the following way:—

Philip Sidney being contracted becomes 'Phil. Sid.,' which is a contraction for Philos Sidus, and the Latin *sidus* being changed to the Greek *astron*, we get *astron-philos* (star-lover). The 'star' that he loved was Penelope Devereux, whom he called *Stella* (star), and to whom he was betrothed.

Edmund Spenser wrote a pastoral called 'Astrophel' to the memory of his friend and patron who fell at Zutphen.

Geography.

Answer either Q. 2 or Q. 3; not both.

1. Explain, as you would to children, the meaning of the lines of *latitude*; and illustrate what you say by reference to a map of Spain and Portugal, in which these lines are carefully marked.

On a terrestrial globe we observe a number of lines drawn *round* it—on a map lines drawn *across* it—parallel to one another. These lines are called parallels of latitude, and are placed on a map or on the globe for the sole purpose of fixing places, and of telling how far these places lie north or south from the middle one on the globe which is called the *equator*. There are usually, in a map of the hemispheres, seventeen of them, eight north, and eight south of the equator, dividing the space between the equator and each pole into nine parts, and these are each of ten degrees (*explain that there are 360° in the circumference*). They are numbered from one to ninety downwards and from one to ninety upwards; those above being parallels of *north* latitude, and those below parallels of *south* latitude.

2. What are the chief causes which affect the climate of a country? Illustrate your answer by reference to different parts of British India.

The chief causes which affect the climate of a country are: (1) its latitude or distance from the equator; (2) its elevation or height above the level of the sea; (3) its nearness to the sea; (4) the slope of the country; (5) the direction of the mountain-chains; (6) the prevailing winds; (7) the nature of the soil; (8) the rainfall; and (9) even the cultivation of the soil.

The climate of a large country like India is of necessity very varied. Its proximity to the equator would lead us to conclude that the climate would be tropical and very warm, but no country of equal extent is so much favoured as India. This arises from the physical inequalities of its surface which prevent the country from being a desert. The Himalayas act as the great modifiers of temperature and provide proper water supply to the rivers in the north as well as to the atmosphere—*see heads* (5) *and* (8).

Owing to certain causes, the wind, instead of blowing from all quarters, blows generally for six months in one direction and six months in the other. These are 'monsoons,' and on these the rain of India depends. Certain districts in the south of the Deccan, which are exposed to both winds, have two rainy seasons, one for each monsoon. The year in India admits for the most part of being divided into three seasons—namely, the *hot*, the *wet*, and the *temperate*. During the hot season, on the low plains of the coast and in the plain of the Ganges, the heat is almost unbearable, but on the Deccan, owing to its elevation, the heat is much subdued—*see heads* (6), (8), *and* (2). The air of the hills is purer and cooler than that of the plains; and therefore the Europeans who suffer from the climate of the plains, betake themselves to the hills to recruit their health. The most unhealthy districts are those in which there is swamp or jungle—*see head* (9)—such as the Terai, the Sunderbunds, and some of the rice grounds on the eastern coast.

3. Trace minutely in words the courses of the Loire, the Rhine, the Brahmaputra, and the Godavery.

The *Loire* rises in the Cevennes, flows with a winding course towards the north as far as Nevers, near which it is joined by the *Allier*, a tributary which, rising in the same chain of mts., flows parallel with the Loire, from which it is separated by a range of hills. From Nevers the Loire proceeds to the north-west until it reaches *Orleans*, where it bends to the west, and continues in this direction till it falls into the Bay of Biscay. In this part of its course it receives the *Cher*, *Indre*, and *Vienne* on the left, and the united *Mayenne*, *Sarthe*, and *Loir* on the right. These are its principal feeders, but the branches received by the Loire are very many, and this river constitutes the great outlet for the produce of central and western France.

The Rhine has its main source in Mt. St. Gothard, passes through the magnificent ravine of the Rheinwald, unites with a second head-stream, and flows through a beautiful valley to Lake Constance. After leaving this lake it forms the celebrated falls of *Schaffhausen*, and, winding between lofty rocks, is joined by the *Aar* and reaches *Basle*. At this town the river turns north, and before it reaches Mentz it is joined by the *Neckar* from the Black Forest, and the *Mayne* from the Fichtelberg in the N.E. of Bavaria. After leaving Mentz it flows west for a short distance through an unbroken succession of picturesque scenery, and then turns N.W., until it enters the flats of Holland. Before this, however, it is joined by the *Moselle* from the Vosges Mts. on the left, and by the *Lahn*, *Ruhr*, and *Lippe*. Entering Holland, it divides into two branches, one called the *Waal*, flows west, and joins the *Maas*; whilst the other called the Rign (Rhine) flows N.W., and falls into the North Sea below *Leyden*. Just after entering Holland the Rhine throws off a branch called the *Yssel*, which falls into the Zuyder Zee; and half-way between Utrecht and Leyden the *Amstel* leaves the main stream, and flows into the estuary called the Y.

The source of the Brahmaputra has not yet been reached by any European, but it is supposed to be in the plateau of Thibet not far from the Sutlej. It flows through the valley of Assam and the province of Bengal, and, joining the Ganges, falls into the Bay of Bengal. The eastern mouth of the Ganges is nearly identical with the main mouth of the Brahmaputra.

The Godavery rises in the Western Ghauts, and passes to the Eastern, flowing through them with such a gentle descent that the navigation is not interrupted either up or down. After a course of nearly 900 miles it falls into the Bay of Pengal.

SECOND PAPER.

Two hours and a half allowed.

History.

1. How came the Normans to invade England? Give some account of their leader, his character and death.

It is said that Edward the Confessor had promised to make William, Duke of Normandy, his heir, and also that Harold, son of Earl Godwin, had sworn a most solemn oath to support William's right to the throne. Harold, however, on the death of Edward, usurped the throne. When William heard of the usurpation he collected a mighty host, and built a great fleet to carry it across to England. Landing at Sussex, William met Harold and his army at Senlac, near Hastings, and after a long and stubborn fight the Normans were victorious. Harold was slain, and William was crowned king on Christmas Day, 1066.

William I., the illegitimate son of Robert, sixth Duke of Normandy, was born at Falaise. He married Matilda, daughter of the Earl of Flanders. William was descended from Rollo, one of the most formidable of the sea-kings, who took possession of a large extent of territory, to which the name of Normandy was given.

After the Battle of Hastings several nobles proclaimed Edgar the Ætheling king; but he resigned in favour of William. During William's temporary absence in Normandy his subjects revolted, but on his return he captured Exeter and York, and laid waste the whole of the northern counties. The last effort made to withstand the Normans was made by Hereward; but he eventually submitted to William's authority.

William established the Feudal System in England, enacted severe forest laws, and introduced the Curfew-bell. It was also in this reign that the Domesday-book, a register of land, was compiled.

Towards the close of his reign William had become exceedingly corpulent, and Philip, the French king, one day indulged in a coarse joke against his person. This gave great offence to the English monarch, who, entering the dominions of Philip, reduced the town of Mantes to ashes. As he was riding among the ashes he received an injury which caused his death.

William was endowed with great natural abilities. He surpassed all other monarchs of his time in capacity for governing, whether in peace or war. On the other hand, he was ambitious and passionate, and although his tyranny caused him to be dreaded by his own subjects, he nevertheless transmitted his power to posterity, and the throne is still filled by his descendants, a proof that the foundations he laid were firm and solid.

2. What events brought the Plantagenets to the throne of this country?

On the death of Henry I., his daughter, Matilda, ought to have succeeded, but Stephen, son of Adela, daughter of William the Conqueror, usurped the throne. During the whole of his reign (1135-1154) civil war raged, sometimes Matilda prevailing and sometimes Stephen. It was at length settled that Stephen should retain the throne so long as he lived, and that Matilda's son, Henry, should succeed him. Henry Plantagenet was the eldest son of Matilda and Geoffrey Plantagenet, Count of Anjou. His mother, Matilda, gave up her right in his favour, and he succeeded to the English throne under the title of Henry II. He was thus the first sovereign of the Plantagenet line.

3. Who were the Tudors? Make a table showing names, dates, and relationship of the sovereigns of that House.

The Tudor line of sovereigns came from Wales. The first of the line was Henry VII., who was grandson of Owen Tudor, a Welsh gentleman, and Catherine, widow of Henry V.

HOUSE OF TUDOR.

Henry VII. (1485-1509)

Henry VIII. (1509-1547)

Edward VI. (1547-1553)	Mary I. (1553-1558)	Elizabeth (1558-1603)

Teaching.

In teaching young children to write, which letters would you choose first, and why?

In teaching young children to write the small letters, it is advisable to begin with *i* and *u*, as the *i* is easily learnt after they have mastered the making of a straight sloping line, and *u* is just *i* repeated twice without the dots.

As *C* is one of the most easily made of the capitals, a beginning might be made with it, to be followed by *E*, *L*, *G*, as they have the loop similar.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

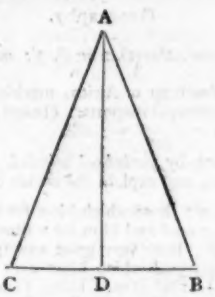
1. From the greater of two given straight lines to cut off a part equal to the less.

What are the data and quæsita in this proposition?

Prop. 3, Bk. I.

The data (*what is given*) are two lines, one greater and one less, and the quæsita (*what is sought*) is the cutting off a part from the greater equal to the less.

2. If the perpendicular from the vertex of a triangle on the base bisect the base, the triangle is isosceles.



Let the perp. AD bisect the base CB, then the triangle ABC is isosceles.

Proof.—CD=DB, AD is common to the two triangles ADC, ADB, and the angles at D are equal, being right angles. Therefore (I. 4) AC=AB, that is, the triangle ABC is isosceles. —Q. E. D.

3. If from the ends of the side QR of the triangle PQR there be drawn two straight lines to the point S within the triangle, these shall be less than the other two sides of the triangle, but shall contain a greater angle.

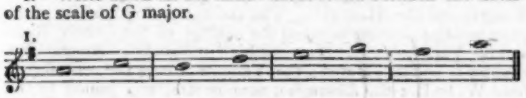
Prop. 21, Bk. I.

Music.

A quarter of an hour allowed for this paper.

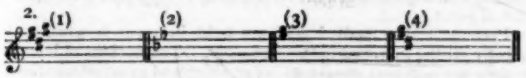
1. Write down all the minor thirds found between the notes of the scale of G major.

1.

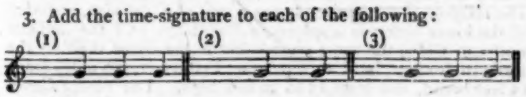


2. Write the proper key-signature of each of the following major keys: (1) A. (2) B flat. (3) G. (4) D.

2.



3. Add the time-signature to each of the following:



3.

TONIC SOL-FA NOTATION.

1. What is the mental effect of the tone of the scale called *fah*?

1. A *desolate* or *awe-inspiring* effect.

2. Write the pulse signs for six-pulse measure.

Primary form.

2. | : . : | : : ‖

3. Write (using four-pulse measure) two notes, each continued through two pulses.

3. |1 :— |1 :— ‖

* Half lines.

THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after,* **1st May, 1878; and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. What would be the broker's commission on the purchase of £3,500 3 per cents. at 97½, brokerage being ⅛ per cent.?

£100 : £3,500 :: £⅛ : ?

$\frac{£1 \times 3{,}500}{8 \times 100} = £4\ 7s.\ 6d.$ Ans.

2. If I purchase 4 per cent. Preference Stock at 127½, and pay a broker ⅛ per cent., what interest per cent. shall I get for my money?

128 : 100 :: £4 : ?

$\frac{£4 \times 100}{128} = £3\frac{1}{8}$ p.c. Ans.

3. What is the amount of a bill due 3 months hence if the true discount on it be £5 7s. 6d., interest charged being 4 per cent.?

Interest on £100 for 3 mos. at 4 p.c. = £1
Discount on £101 " " " = £1
∴ £1 : £$5\frac{1}{8}$ :: £101 : ?

$\frac{£101 \times 43}{8} = £542\ 17s.\ 6d.$ Ans.

4. Find the square root of 144·7 to 3 places of decimals, and show that $\sqrt{13\frac{1}{9}} = 3{\cdot}6$.

(*a*)
```
1   | 144·7(12·029... Ans.
    | 1
22  | 44
    | 44
2402| 7000
    | 4804
24049| 219600
    | 216441
    | ......
```

(*b*) $\sqrt{13\frac{1}{9}} = \sqrt{\frac{118}{9}}$
" = $\frac{11}{3}$
" = 3·6 Q. E. D.

FEMALES.

1. Divide 8·8779 by 175·8.

```
175·8)8·8779(·0505. Ans.
      8790
      8790
      ----
```

2. Find the value of 5·14583 of £8.

```
£5·14583
       8
-------
£41·16
   20
-------
3·3s.
```

£41 3s. 4d. Ans.

3. What decimal of £7 16s. 10·4d. is £6 7s. 5·45d.?

£6 7s. 5·45d. = 1529·45
£7 16s. 10·4d. 1882·4
" = ·8125. Ans.

4. A book containing 218 leaves is 1·295 inches thick, allowing ·08 of an inch for the thickness of the cover, find to 6 places of decimals the thickness of the paper.

Thickness of book = 1·295 in.
" cover = ·16 "
" leaves = 1·135 "

```
218)1·135(·005206.. in. Ans.
   1090
   ----
    450
    436
    ---
     1400
     1308
     ....
```

5. If $\frac{4}{17}$ ton cost £6, what would 7½ cwt. cost at the same rate?

$\frac{4}{17}$ ton or $\frac{160}{17}$ cwt. : 7½ cwt. :: £6 : ?

$$\frac{£6 \times 68 \times 13}{9 \times 100} = £\frac{1768}{300}$$

" $= £5\ 17s.\ 10\frac{4}{5}d.$ Ans.

Grammar.

1. 'They heard, and were *abashed*, and *up* they sprung
Upon the wing, *as* when men *wont* to watch,
On duty sleeping *found by whom* they dread,
Rouse and bestir themselves *ere* well *awake*.'

Analyse and paraphrase this passage. Parse the words in italics.

SENTENCE.	KIND.	SUBJECT.	PREDICATE.	OBJECT.	EXTENSION.
(1) They heard	Principal	they	heard		
(2) and (they) were abashed	Principal	(and) (they)	were abashed		
(3) and up they sprung upon the wing,	Principal	(and) they	sprung		up, upon the wing
(4) as when men wont to watch on duty, sleeping found, by whom they dread, rouse (themselves)	Subord Adverbial	(as when) men wont to watch . . . dread	rouse	(themselves)	
(5) (as when . . . dread) bestir themselves	Do.	Do.	bestir	themselves	
(6) whom they dread	Subord. Noun	they	dread	whom	
(7) ere (they are) well awake.	Subord. Adverbial	(ere) (they)	(are) awake		well

PARAPHRASING.

When soldiers, who should have been faithfully keeping guard, are found sleeping at their post by him of whom they stand in awe, they, in a half-slumbering state, generally bustle about to conceal their neglect. So these angels, at the rebuke, were ashamed, and immediately began to display the greatest activity.

PARSING.

Abashed—predic. adjective, qual. 'they.'
up—adv., mod. 'sprung.'
as—subord. adv. conj., introducing a subord. sent.
wont—predic. adj., qual. 'men' (old participle).
found—complete part. of the irreg. verb *find, found, found*, qual. 'men.'
by—prep., gov. (him), or gov. the sent. 'whom they dread.'
whom—rel., containing both antecedent and rel. = *him whom*, sing., masc., obj., gov. by 'dread'
rouse—reg. trans. verb, indic., pres. indef., 3rd pers., plur., agr. with subj. 'men.'
ere—subord. adv. conj., introducing subord. sent. '(they are) well awake.'
awake—predic. adj., qual. (they).

2. Analyse the following words, showing in any of them (*a*) the prefix, (*b*) the affix, (*c*) the language whence derived:—Anatomy, transit, repel, descend, unwise, ashore, abundance, behead, fanatic, knowledge, manhood, wilderness, riches.

WORD.	PREFIX.	LANGUAGE.	WORD.	AFFIX.	LANGUAGE.
anatomy	ana	Greek	fanatic	ic	Latin
transit	trans	Latin	knowledge	ledge	A. Saxon
repel	re	"	manhood	hood	"
descend	de	"	wilderness	ness	"
unwise	un	A. Saxon	riches	es	French
ashore	a	"			
abundance	ab	Latin			
behead	be	A. Saxon			

3. By what endings may adjectives and verbs of purely English origin be recognised? Give examples.

Purely English adjectives may be recognised by the following terminations, namely: *-en, -ern, -er, -fast, -fold, -ful, -ish, le, -m, -less, -like, -ow, -right, -teen, -eth, -ty, -ward, -y*; as, wood*en*, west*ern*, clev*er*, stead*fast*, mani*fold*, thank*ful*, whit*ish*, litt*le*, gri*m*, thank*less*, war*like*, shal*low*, down*right*, thir*teen*, fif*th*, six*ty*, awk*ward*, ston*y*.

Geography.

Answer either Q. 2 or Q. 3; not both.

1. Draw an outline map of Africa, marking the bays, capes, river mouths, and principal seaports. (Insert the lines of latitude and longitude.)

2. What is meant by *periodical winds?* Name any which affect Asia or Africa, and explain the causes of them.

Periodical winds are those which blow for a time in one direction and then turn round and blow for a time in another, and so on alternately. We have very good examples of periodical winds in the 'Monsoons,' which blow over the Indian Ocean between Africa and Hindostan. From October to April they blow from the N.E., and from April to October from the S.W. They blow with great regularity between the eastern coast of Africa and India. When the sun is in the southern hemisphere a N.E. wind blows over this sea, and when it is in the northern hemisphere a S.W. wind blows over it. The N.E. wind brings rain on the eastern coast of Africa. The S.W. wind brings rain to the west coast of India, and this monsoon is supposed to be produced by the great rarefaction of the atmosphere over the vast regions of eastern Asia during the summer months. The monsoons prevail also on the seas between Australia and China.

3. Give notes of a lesson on the physical features of China, and the character of the inhabitants.

PHYSICAL FEATURES.—*Surface and Mountains*—Eastern half consists mainly of the lower basins of the Peiho, Hoangho, Yangtse, and Canton Rivers; mostly a great alluvial plain, celebrated for its fertility and density of population; western half is highly mountainous; the Yunling runs N. and S. between the upper courses of the Hoangho and Yangtse; from this range three other ranges proceed eastward to near the coast, namely, the Yu-ling, S. of the Canton River; the Nan-ling, between the Canton river and the Yangtse; and the Peling between the Yangtse and the Hoangho. The coasts are low and in some parts swampy, except between the mouths of the Canton River and the Yangtse, where they are high and rocky. *Rivers*—No country is better watered; the Yangtse crosses the central part from W. to E.; the Hoangho, next in size, and joined to the former by the Grand Canal, is said to furnish the most magnificent system of water communication in existence. The *Lakes* are mere enlargements on the rivers, and, though numerous, are not of great extent.

PEOPLE.—The learned men are held in great honour, and occupy all the important offices of state. The notions of female beauty are peculiar, small feet being objects of great admiration. The religion of the upper classes is that of Confucius, and that of the lower orders is a species of Buddhism. Of the national works of China the most remarkable is the *Great Wall* on the northern frontier, built to repel the Tartars, 1,250 miles long, 15 feet broad, and from 15 to 30 feet high. The *Grand Canal* is 700 miles, 200 feet broad at the surface, and is often from 60 to 70 feet deep.

Rice, the principal food, is eaten with chop-sticks, requiring much art to use; pork is a favourite meat, but dog's flesh is considered a delicacy, and even rats and mice are relished by the lower orders; tea is drunk without cream or sugar, and a great luxury is the edible birds'-nests from Java.

The people are very deceitful, and in their vanity call their country the 'Celestial Empire.' They are very skilful in carving ivory, but their paintings show no knowledge of perspective.

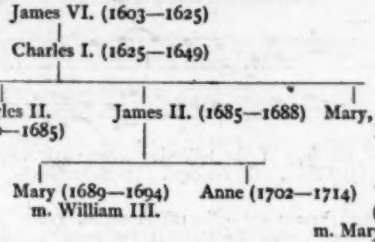
SECOND PAPER.

Two hours and a half allowed.

History.

1. How came the Stuarts to ascend the throne of England? Make a table, showing names, dates, and relationship of Sovereigns of that House.

In 1502 a marriage was arranged between James IV. of Scotland, and Margaret, eldest daughter of Henry VII. From this marriage resulted the union of the English and Scottish crowns in the person of James VI. James was the *first of the Stuart line* on the English throne. By the death of Elizabeth without heirs, James, who represented the Tudor claim, became the undisputed monarch of the whole island.


James VI. (1603—1625)
Charles I. (1625—1649)
Charles II. (1660—1685)
James II. (1685—1688)
Mary, m. William, P. of Orange
Mary (1689—1694) m. William III.
Anne (1702—1714)
William III. (1689—1702) m. Mary of England

2. Upon the death of Queen Anne who were the next heirs to the throne? What claim had the prince who actually succeeded her?

On the death of Anne the next heir was Prince Edward Stuart, son of James II. By the Act of Settlement he was disinherited, and the crown was settled on George, Elector of Hanover, who was great grandson of James I.

3. Which of our kings had the longest reign? Mention the chief events of it, and compare the power of the people at its beginning and its close.

George III. (1760—1820) had the longest reign of any of our kings.

CHIEF EVENTS OF THE REIGN.

1765. Passing of the Stamp Act.
1768. Expulsion of Wilkes from Parliament.
1771. Last attempt to prevent the publication of Debates.
1774—1783. American War of Independence.
1786. Trial of Warren Hastings.
1789. French Revolution.
1793. France declares war with England.
1798. Revolt in Ireland.
1800. Act of Union with Ireland.
1805. Battle of Trafalgar.
1807. Orders in Council.
,, Abolition of Slave Trade.
1808. Peninsular War begins.
1812. War with United States.
1811. Prince of Wales Regent.
1815. Napoleon returns from Elba and is defeated at Waterloo.
,, Passing of Corn Law.
1817. Death of Princess Charlotte.

The great defect in the power of the people in the beginning of the reign resulted from the fact that Parliament did not represent the people of England. But the struggle between Wilkes and the Commons, who had limited the free election of the Middlesex constituency, gave a new power to the literature of the press, and from the quarrels between him and the House we may date the influence of public meetings on English politics. It is, however, to the Press that the people are mainly indebted for their power. A new and wider interest in its own affairs was roused in the people at large, and public opinion as gathered from all sides by the journals became a force in practical statesmanship, influenced the course of debates, and controlled the actions of the Government in a closer way then even Parliament itself had been able. These influences, though feebly felt in the beginning of the reign, gained strength as time rolled on.

Teaching.

Sketch out notes of a lesson on *The Clothing of Animals.*

ARTICLES TO BE SEEN.—*Feathers, down, fur, wool, hair, in natural state if possible; pictures of various animals.*

USES OF CLOTHING.—Clothing protects the body; keeps the heat in in cold countries; protects the body from heat in hot countries. Man, the higher animal, has to clothe himself; lower animals are clothed by nature; this clothing cast off in summer, and thickened in winter (*ask instances from children's own observation*); hens cast feathers; sheep cast wool (to prevent loss farmer cuts it off); serpents cast skin. *Down*, the covering of young birds (*why?*)

KINDS OF CLOTHING.—*Feathers* cover hens, ducks, all kinds of birds (*ask names, and show why feathers are best for covering birds*). *Wool* clothes sheep. *Fur* clothes hares, rabbits, cats (*compare Muscovy cat and common cat*), (*elicit others*). *Hair* covers dogs, horses, etc. *Bristles* cover pigs. *Quills* on porcupines, hedgehog (*draw out description*). *Recall a visit to a menagerie, and gather recollections of what was seen and what the animals were covered with.*

FITNESS OF THE VARIOUS COVERINGS.—Animals' covering suited to the climate in which they live; *wool* of Northern sheep changes to a species of *hair* in the tropics; *dog* of torrid zone nearly destitute of hair; nature has provided for their protection against all changes of temperature by covering their bodies with a form of hair, or fur, or feathers, in the exact degree required, and to such an extent as to vary the covering in the same animal according to climate and season.

Euclid.

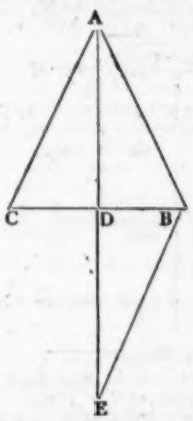
MALES.

[All generally understood abbreviations for *words* may be used.]

Answer two questions, including Question 1, *if you can.*

1. If a straight line which bisects the vertical angle of a triangle also bisects the base, the triangle is isosceles.

Let the straight line AD which bisects the angle CAB bisect also the base CB in D; then ABC is an isosceles triangle.



Produce AD to E making DE=AD, and join BE.

Then because AD=DE, CD=DB and angle ADC=angle BDE (I. 15), then (I. 4) the triangle ADC is equal in every respect to the triangle BDE. ∴ the side CA=BE and angle BED=CAD=BAD (Hyp.); and hence the triangle ABE is isosceles that is BA=BE, but BE=AC. ∴ the triangle ABC is isosceles. Q. E. D.

2. Equal triangles upon the same base and on the same side of it are between the same parallels.

Prop. 39, Bk. I.

3. To a given straight line to apply a parallelogram, which shall be equal to a given triangle, and have one of its angles equal to a given rectilineal angle.

Prop. 44, Bk. I.

Algebra.

MALES.

Answer two questions.

1. When $a=3$, $b=7$, find the value of:—

$$35a^4-9\{2b^2(a^2-b^2)-5a^2b\}+\tfrac{17}{108}ab(2a-3b)(3a-2b)$$

$$35a^4-9\{2b^2(a^2-b^2)-5a^2b\}+\tfrac{17}{108}ab(2a-3b)(3a-2b)$$

$$35\times 81-9\{98(9-49)-5\times 189\}+\frac{17\times 21(6-21)(9-14)}{105}$$

$$2835-9(-3920-945)+\frac{17\times 21\times 75}{105}$$

$$2835+43{,}785+255=\underline{46{,}875}.\quad \text{Ans.}$$

2. Find the G.C.M. of $4x^3 + 5a^2x - 21a^3$ and $2x^3 + 5ax^2 - 30a^2x + 27a^3$; and the L.C.M. of $a^2 + ab - 12b^2$ and $a^2 - 5ab + 6b^2$.

(*a*) $2x^3 + 5ax^2 - 30a^2x + 27a^3$) $4x^3 + 5a^2x - 21a^3$ (2
$4x^3 + 10ax^2 - 60a^2x + 54a^3$
$-5a) - 10ax^2 + 65a^2x - 75a^3$
$2x^2 - 13ax + 15a^2$

$2x^2 - 13ax + 15a^2$) $2x^3 + 5ax^2 - 30a^2x + 27a^3$ (x
$2x^3 - 13ax^2 + 15a^2x$
$9a) 18ax^2 - 45a^2x + 27a^3$
$2x - 5ax + 3a^2 = (2x - 3a)(x - a)$
and $2x^2 - 13ax + 15a^2 = (2x - 3a)(x - 5a)$
$\therefore$ $\underline{(2x - 3a)}$ = G.C.M. Ans.

(*b*) $a^2 + ab - 12b^2 = (a - 3b)(a + 4b)$
$3a^2 - 5ab + 6b^2 = (a - 3b)(a - 2b)$
$\therefore$ L.C.M. = $\underline{(a - 3b)(a + 4b)(a - 2b)}$. Ans.

3. Solve the equations:—(1) $bx(a - b) + ax(b - a) + (a + b)^3 - 4abx = 0$.

(2) $\frac{x-7}{11} - \frac{3x-5}{7} + \frac{125}{77} = 2x - 17$.

(1) $bx(a - b) + ax\ b - a) + (a + b)^3 - 4abx = 0$
$abx - b^2x + abx - a^2x + (a + b)^3 - 4abx = 0$
$a^2x + 2abx + b^2x = (a + b)^3$
$x(a + b)^2 = (a + b)^3$
$x = \underline{a + b}$. Ans.

(2) $\frac{x-7}{11} - \frac{3x-5}{7} + \frac{125}{77} = 2x - 17$

$7x - 49 - 33x + 55 + 125 = 154x - 1309$
$7x - 33x - 154x = 49 - 125 - 1309 - 55$
$180x = 1440$
$x = \underline{8}$. Ans.

Mensuration.

Answer one question.

1. Find the height of a parallelogram whose area is $3\frac{1}{2}$ acres and base 242 yards.

$$\text{Perp. height} = \frac{3\frac{1}{2} \text{ ac.}}{242 \text{ yds.}} = \frac{4840 \text{ yds.} \times 3\frac{1}{2}}{242} = \underline{70 \text{ yds.}} \text{ Ans.}$$

2. Find to three decimal places the area of the triangle whose sides are 6, 7, 9.

$$\text{Area of triangle} = \sqrt{11 \times 5 \times 4 \times 2} = \sqrt{440}$$

```
 2 | 440(20·976..   Ans.
   | 4
409| 4000
   | 3681
4187| 31900
   | 29309
41946| 259100
   | 251676
   ......
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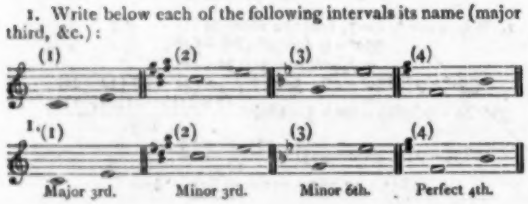
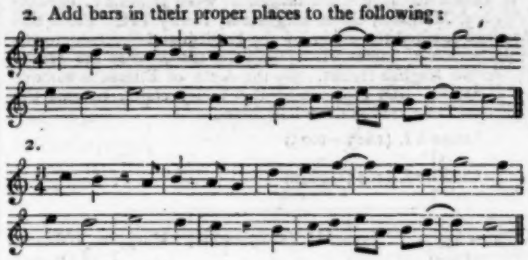
Music.

A quarter of an hour allowed for this paper.

1. Write below each of the following intervals its name (major third, &c.):



2. Add bars in their proper places to the following:



3. Give the meaning of the following terms: (1) *Staccato.* (2) *Andante.* (3) *Vivace.* (4) *Da capo.* (5) *Rallentando.* (6) *Crescendo.*

3. (1) Staccato means *cut off.* (2) Andante, *going at a moderate pace.* (3) Vivace, *lively.* (4) Da capo, *return to the beginning.* (5) Rallentando, *slackening (the pace).* (6) Crescendo, *increasing (in loudness).*

TONIC SOL-FA NOTATION.

1. Write a pulse and divide it into halves, and another and divide it into quarters.

1. | 1 .1 :1 ,1 .1 ,1 ‖

2. What does the direction "M. 72" mean?

2. "M. 72" placed before a tune means that the *pulses* of that tune move at the rate of 72 in a minute.

3. What do (1) *forte.*, (2) *crescendo*, and (3) *rallentando* mean?

3. (1) Forte means *loud;* (2) crescendo, *increasing (in loudness);* (3) rallentando, *slackening (the pace).*

FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after,* **1st *May*, 1878; and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. What is the price of stock, if a person can purchase £2343 15s. stock for £2250, brokerage being $\frac{1}{8}$ per cent.?

£2343¾ : £2250 :: £100 : price of stock to buyer
$\frac{£100 \times 2250 \times 4}{9375} = £96$
$\therefore$ Price of stock = $95 - \frac{1}{8} = \underline{95\frac{7}{8}}$ nett. Ans.

2. A person who has £7800 India stock, paying 5 per cent., sells out at 125 and reinvests the money in 4 per cent. railway stock at 97½; find the increase in his income, brokerage of $\frac{1}{8}$ being charged on each transaction.

97½ : 124⅞ :: £7800 : stock in 4 p.c.
$\frac{£7800 \times 999}{780} = \underline{£9990}$ at 4 p.c.

	£	s.
Income from 1st investment = $\frac{7800 \times 5}{100}$ =	390	0
,, 2nd ,, = $\frac{9990 \times 4}{100}$ =	399	12
Difference of income =	9	12. Ans.

3. A draper buys gloves in Paris at 45 francs per dozen pairs, and sells them in England at 4s. 2d. a pair. What percentage does he gain if £1 = 25·15 francs?

Price of a dozen pairs in England = 50s. = £$\frac{5}{2}$ = £$\frac{1000}{400}$
,, ,, France = 45fr. = £$\frac{4500}{2515}$ = £$\frac{900}{503}$ = £$\frac{1800}{1006}$
Gain on a doz. pair £$\frac{794}{1006}$
$\therefore$ 1800 : 715 :: 100 : ?
$\frac{100 \times 715}{1800} = \underline{39\frac{1}{2}}$. Ans.

4. A grocer buys 2 cwt. of tea at £13 per cwt., and another cwt. He mixes the whole and sells the mixture at 2s. 9d. per lb., and thereby gains 15½ per cent. What was the cost of the third cwt.?

Selling price of the mixture = 2s. 9d. × 336 = 924s.

∴ 115½ : 100 :: 924s. : buying price of the 3 cwts.

$$\frac{924s. \times 100 \times 2}{231} = 800s. = £40$$

∴ 3rd cwt. cost £40 − £(13 × 2) = £14. Ans.

FEMALES.

1. Find the principal which will produce £6 10s. 9½d. interest in 10 months at 5 per cent.

10 mos. : 12 mos.
5 : £6 10s. 9½d. } :: £100 : principal

$$\frac{£6\ 10s.\ 9\tfrac{1}{2}d. \times 12 \times 100}{10 \times 5} = £156\ 18s.\ 6d.$$ Ans.

2. 46⅞ sovereigns of full weight are equal to a pound troy. What will be the weight of a sovereign when 2·1 per cent. of the metal has been worn off?

Original weight of 1 sov. $= \frac{240 \text{ dwts.}}{46\frac{7}{8}}$

" $= \frac{3200}{623}$ dwts.

∴ 100 : 97·9 :: $\frac{3200}{623}$ dwts. : weight of worn sov.

$$\frac{3200 \text{ dwts.} \times 97{\cdot}9}{623 \times 100} = \frac{3132{\cdot}8}{623} \text{ dwt.} = 5\tfrac{317}{623} \text{ dwts.}$$ Ans.

3. How much per cent. will be added to a person's income by a reduction in the income tax from 10d. to 6d. in the pound?

He has now 234d. instead of 230d. in the £

∴ 230 : 100 :: 4 : gain p.c.

$$\frac{4 \times 100}{230} = 1\tfrac{17}{23} \text{ p.c.}$$ Ans.

4. If 4418 tons of iron ore produce £7238 worth of metal, when iron is 75s. per ton, what would be the value of the iron from 2275 tons of ore, at 94s. per ton?

4418 tons : 2275 tons
75s. : 94s. } :: £7238 : ?

$$\frac{£7238 \times 2275 \times 94}{4418 \times 75} = £4671\ 6s.\ 8d.$$ Ans.

3. How many days, 8 hours long, would 60 men take to finish some work which 24 men could do in 15 days, working 10 hours a day?

8 ho. : 10 ho.
60 men : 24 men } :: 15 days : ?

$$\frac{15 \text{ days} \times 10 \times 24}{8 \times 60} = 7\tfrac{1}{2} \text{ days.}$$ Ans.

Grammar.

1. '*Avenge*, O *Lord*, Thy slaughtered *saints whose* bones
Lie *scattered* on the Alpine mountains cold;
Even them who kept Thy truth so *pure* of *old*
When all our fathers worshipped stocks and stones
Forget not.'

Analyse the above, parsing the words in italics.

SENTENCE.	KIND.	SUBJECT.	PREDICATE.	OBJECT.	EXTENSION
(1) Avenge, O Lord, Thy slaughtered saints.	Principal	(Thou) O Lord	avenge	Thy slaughtered saints	
(2) Whose bones lie scattered on the Alpine mountains cold.	Adjective to (1)	whose bones	lie		scattered on the Alpine mountains cold
(3) Even them forget not.	Principal	(Thou)	forget not	them	
(4) Who kept Thy truth so pure of old.	Adjective to (3)	who	kept	Thy truth	so pure (complement) of old (time)
(5) When all our fathers worshipped stocks and stones.	Adverbial to (4)	all our fathers	worshipped	stocks and stones	When(time) (also connect.)

PARSING.

Avenge—reg. trans. verb, imper., 2nd pers., sing., agr. with ('Thou').
Lord—prop. noun, mas., sing., nom. of address, or vocative case.
saints—com. noun, mas. or fem., plur., obj., gov. by 'avenge.'
whose—simple rel., referring to 'saints,' mas. or fem., plur., poss., attrib. to 'bones.'
scattered—complete part. of reg. trans. verb 'scatter,' pre- of 'bones.'
even—adv., giving emphasis to the distinguishing force in 'them.'
them—demonstr. pron., 3rd pers., mas. or fem., plur., obj., gov. by 'forget.'
pure—adv., mod. 'kept,' or pred. adj. qual. 'truth.'
old—adj., used as noun abstr., neut., sing., obj., gov. by 'of.'
forget—irreg. trans. verb *forget, forgot, forgotten*, or *forgot*, imper., 2nd pers., sing., agr. with (Thou).

2. What is meant by an *inflected* language? Give instances of grammatical inflection in English.

An *inflected* language is one which changes the forms of its words in order to express different relations, or some modification of the notion for which the word stands. Inflection, in strictness of language, is any change which takes place in a word from a modification of its sense between the *root* and the *termination*.

In English some inflections are made by a change in the termination of words, as *book, books; turn, turned*; others consist in a change of the vowel sound, as *fight, fought; bind, bound; goose, geese*. All the parts of speech in English are more or less inflected, except prepositions, conjunctions, and interjections; but some confine inflection entirely to declension and conjugation.

3. Name the chief writers in—

(*a*) The Saxon period.
(*b*) The Elizabethan period.
(*c*) The present century.

And mention the great works of each.

WRITERS.	WORKS.
(*a*) Caedmon	'The Creation.'
Baeda (Bede)	'Ecclesiastical History.'
King Alfred	Translated 'Bede's History' and 'Æsop's Fables.'
(*b*) Edmund Spenser	'Shepherd's Kalendar'; 'Faerie Queene.'
Francis Bacon	'Essays'; 'Advancement of Learning'; 'Novum Organum.'
William Shakespeare	'Love's Labour Lost'; 'Julius Cæsar'; 'Hamlet'; 'The Tempest'; 'Sonnets,' and numerous other Plays.
Ben Jonson	'Every Man in his Humour.'
Sir Walter Raleigh	'History of the World.'
William Drummond	'Sonnets'; 'Religious Poems.'
(*c*) Wordsworth	'The Excursion'; 'Ballads.'
Lord Byron	'Childe Harold'; 'Don Juan.'
Sir Walter Scott	'Waverley Novels'; 'Lady of the Lake'; 'Marmion.'
Campbell	'Pleasures of Hope'; 'Naval Songs.'
Thomas Carlyle	'Sartor Resartus'; 'French Revolution.'
Lord Macaulay	'Lays of Ancient Rome'; 'History of England.'
Tennyson	'In Memoriam'; 'Idylls of the King'; 'Queen Mary.'
Browning	'Pauline'; 'Dramatic Lyrics.'
Dickens	'Pickwick Papers'; 'David Copperfield'; 'Barnaby Rudge.'
Thackeray	'Vanity Fair'; 'The Newcomes.'
Ruskin	'Modern Painters'; 'The Seven Lamps of Architecture.'

Geography.

Answer either Q. 1 or Q. 2; not both.

1. What is meant by periodical winds? And what are the causes of them? Give examples.

See same Question under 'Third Year.'

2. Give notes of a lesson on 'The Seasons,' Illustrate by a diagram.

Diagram to be drawn representing the sun in the centre, and the earth in four positions in its orbit 90° apart, namely, (1) the position it has on the 21st of March, or at the time of the vernal equinox; (2) that of the 21st of June, or the summer solstice; (3) that of the 21st of September, or the autumnal equinox; and (4) that of the 21st of December, or winter solstice.

CAUSE OF THE SEASONS.—In the annual motion of the earth, its axis preserves at all times the same direction, as if its motion round the sun had no existence, and is carried round parallel to itself, and pointing always to the same spot among the fixed stars. (*Refer to diagram, showing and explaining parallelism of the earth's axis.*) This is what gives rise to the variety of seasons.

EXPLANATION.—In each of the positions of the earth (the diurnal rotation not interfering with annual motion), since the sun can only illumine one-half of the surface at once (*refer to diagram*), the shaded portion in the various positions of the earth will represent the dark and the bright will denote the enlightened halves of the earth's surface. Now, in position (1) it is day over half the northern and half the southern hemisphere at once; and as the earth revolves on its axis every point of its surface describes half its diurnal course in light and half in darkness—that is, day and night is equal over the globe; hence the term *equinox*. The same thing holds good at the autumnal equinox in position (3). In position (2) it is the time of the *northern* summer solstice. Here the north pole (*refer to diagram*) and a considerable portion of its neighbourhood are situated within the *enlightened* half. As the earth turns on its axis in this position, the whole of that part is constantly illumined, giving continual day in the *arctic circle* (*explain*), while in the *antarctic circle* there is continual darkness. Again, the nearer any point is to the north pole the longer will be its day and the shorter its night, and every spot north of the equator will have a day of more and a night of less than twelve hours' duration, and every spot south of the equator a longer night and a shorter day. In position (4) all these phenomena are exactly reversed.

N.B.—During the lesson appeal to what the children themselves have observed in the changes of the year, and explain all the terms, using the blackboard freely.

3. Draw a full map of South America.

SECOND PAPER.

Two hours and a half allowed.

History.

1. What do you regard as the most valuable rights of a Briton? Explain briefly how each of the rights you mention was obtained.

The most valuable rights of a Briton are those embodied in the *Declaration of Rights*, 1689 (now *Bill of Rights*), obtained from William and Mary, setting forth the fundamental principles of the Constitution. The chief items are these:—The Crown is forbidden to make laws or dispense with them; to levy taxes; to keep a standing army without consent of Parliament. The Members of Parliament are free to utter their thoughts; a Parliament is to be convened every year; elections are to be free; trial by jury is to be inviolate; and subjects have a right to petition their sovereign. In *Habeas Corpus* (which is similar to Magna Charta), passed in the reign of Charles II. (1679), it is provided that no one can be imprisoned on mere suspicion, and no one can be left in prison any indefinite time at the caprice of the higher powers; every person accused of crime shall have his guilt decided by a jury, and not by a Government agent.

2. What period was most remarkable for extension of our possessions in Asia and North America by conquest. Give some particulars, with names of our greatest generals.

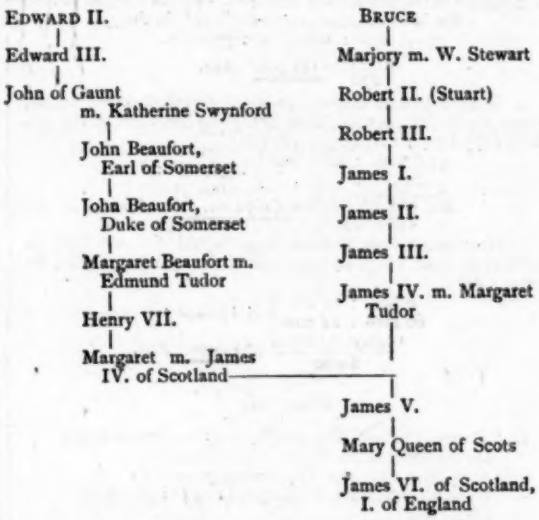
The period most remarkable for the extension of our possessions in Asia and North America was the time of the 'Seven Years' War' (1756-1763).

Under Pitt's administration the war was carried on. *James Wolfe* took Quebec (1759), and within a year Canada was in British hands.

In India an empire was won, and the foundations of that empire were laid by *Clive*. His first exploit was the defence of *Arcot*, and in 1757, by the great victory of *Plassy*, he avenged the horrible affair of the 'Black Hole,' and won the province of Bengal. The mastery of the Carnatic was gained by *Eyre Coote's* victory over the French at Wandewash (1760). Next year Pondicherry surrendered to the English, and though it was afterwards given back, the French never recovered their power, and their power in India soon came to an end.

3. Sir A. Alison once mentioned to the Queen that both armies at Bannockburn were commanded by her ancestors. Soon after Her Majesty said, 'I am thankful I am descended from Mary. I have nothing to do with Elizabeth.' Show the historical accuracy of these remarks.

The descent of Queen Victoria from Edward II. and Robert Bruce, the leaders at Bannockburn, is seen from the following table:—



Elizabeth, daughter of James I., married Frederick, Elector Palatine; their daughter was Sophia, mother of George I., father of George II., grandfather of George III., whose son Edward, Duke of Kent, was the father of

QUEEN VICTORIA.

Teaching.

Sketch out notes of a lesson on *The Clothing of Animals.*

See same Question answered under 'Third Year.'

Euclid.

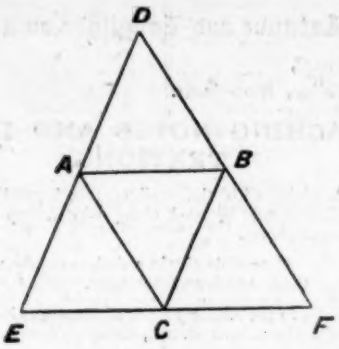
MALES.

[All generally understood abbreviations for *words* may be used.]

Answer two Questions, including Question 1, if you can.

1. Given the middle points of the sides of a triangle, to construct it.

Let ABC be the middle points of the sides; join AB, BC, CA. Through A draw DAE parallel to BC, through B draw DBF parallel to AC, and through C draw FCE parallel to AB. Then DFE is the triangle required.



Proof.—Because (by construction) the figures ADBC, ABCE, are parallelograms AD = BC = AE.

∴ A is the middle point of DE.

For the same reason DB = AC = BF, and EC = AB = CF.

Hence B is the middle point of DF, and C the middle point of EF. Q. E. F.

2. If a straight line be divided into two equal parts, and also into two unequal parts, together with the square on the line between the points of section, is equal to the square on half the line.

Prop. 5, Bk. II.

3. In obtuse-angled triangles, if a perpendicular be drawn from either of the acute angles to the opposite side produced, the square on the side subtending the obtuse angle is greater than the squares containing the obtuse angle, by twice the rectangle contained by the side upon which, when produced, the perpendicular falls, and the straight line intercepted without the triangle between the perpendicular and the obtuse angle.

Prop. 12, Bk. II.

Algebra.

MALES.

Answer two Questions.

1. Simplify: –

$$\left(\frac{1}{a+x}+\frac{1}{a-x}-\frac{4a}{a^2-x^2}-\frac{2a}{a^2+x^2}\right)\div\frac{a}{a+x}$$

$$\left\{\left(\frac{a-x+a+x}{a^2-x^2}\right)-\left(\frac{4a^3+4ax^2}{a^4-x^4}\right)\right\}\div\frac{a}{a+x}=$$

$$\left(\frac{2a}{a^2-x^2}-\frac{6a^3+2ax^2}{a^4-x^4}\right)\div\frac{a}{a+x}=$$

$$\frac{2a^3+2ax^2-6a^3-2ax^2}{a^4-x^4}\div\frac{a}{a+x}=$$

$$\frac{-4a^3(a+x)}{(a^2-x^2)(a^2+x^2)\times a}=$$

$$\frac{-4a^3\times a+x}{(a^2-x^2)(a^2+x^2)\times a}=$$

$$\frac{4a^3\times(a+x)}{(a+x)(x-a)(a^2+x^2)a}=$$

$$\frac{4a^2}{x^3-ax^2+a^2x-a^3}$$ Ans.

2. Solve the equations:—

$$(1)\quad \left.\begin{aligned}2x+\cdot4y&=1\cdot2\\3\cdot4x-\cdot02y&=\cdot01\end{aligned}\right\}$$

$$(2)\quad \frac{77}{(x-1)^2}=45+\frac{64}{x-1}$$

(1) $2x+\cdot4y=1\cdot2 \equiv 2x+\cdot4y=1\cdot2$

$3\cdot4x-\cdot02y=\cdot01=68x-\cdot4y=\cdot2$ (multiplying by 20).

adding $70x = 1\cdot4$

$x = \cdot02$. Ans.

whence $y = 2\cdot9$. Ans.

(2) $\frac{77}{(x-1)^2}=45+\frac{64}{x-1}$

$77=45(x-1)^2+64(x-1)$

$(x-1)^2+\frac{64}{45}(x-1)=\frac{77}{45}$

$(x-1)^2+\frac{64}{45}(x-1)+\left(\frac{32}{45}\right)^2=\frac{77}{45}+\frac{1024}{45^2}=\frac{4489}{45^2}$

$x-1+\frac{32}{45}=-\frac{67}{45}$

$x=\pm\frac{67}{45}+\frac{32}{45}=\frac{99}{45}$, or $-\frac{35}{45}$. Ans.

3. A man bought a horse and carriage for £100, and sold the horse at a gain of 50 per cent., and the carriage at a loss of 25 per cent. On the whole he gained 5 per cent.; what did he pay for the horse?

Let x = buying price of horse, and ∴ $(100-x)$ = price of carriage.

then $\frac{3}{2}x$ = selling " "

and $\frac{3}{4}(100-x)$ = " " carriage.

$$\therefore \tfrac{3}{2}x+\tfrac{3}{4}(100-x)=105$$

$$6x+300-3x=420$$

$$3x=120$$

$$x=40.$$ Ans.

Mensuration.

MALES.

The rent of a square field at £2 14s. 6d. per acre amounts to £27 5s. 0d.; find the cost of putting a paling round the field at 9d. a yard.

$$\text{Area of field}=\frac{£27\ 5s.}{£2\ 14\cdot5s.}=\frac{545}{54\cdot5}=10 \text{ acres.}$$

10 acres = 48,400 sq. yds.

∴ side = $\sqrt{48{,}400}$ = 220 yds.

Length of paling required = 220 × 4 = 880 yds.

880 yds. at 9d. per yd. = £33. Ans.

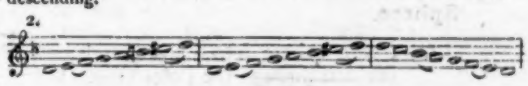
Music.

A quarter of an hour allowed for this paper.

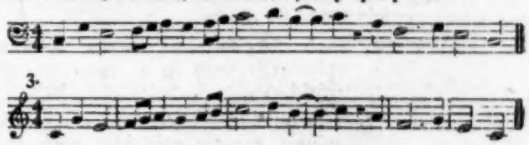
1. Write under each of the following intervals its name (major third, &c.):

Major 3rd. Minor 6th. Diminished 7th. Pluperfect 4th.

2. Write out the scale of D minor in two forms ascending and descending.



3. Transpose the following one octave higher, writing it in the treble stave; and also, add bars in their proper places:



TONIC SOL-FA NOTATION.

1. What is the interval (1) between *doh* and *se*, and (2) between *fah* and *te*?

1. (1) An augmented fifth. (2) A pluperfect fourth.

2. Write out the minor scale in at least two forms.

2. l, t,d r m f(s) se l } Ascending.
   l, t,d r m (f) ba (s) se l }
   l s fm r dt, l, Descending.

3. What is the name (1) for *ray* sharp and (2) for *te* flat?

3. (1) *Ray* sharp is *re*, and (2) *te* flat is *ta*.

Notes of Lesson on 'How to Draw the Lines of Latitude and Longitude on a Map.'

BY JOSEPH H. COWHAM, F.G.S.,
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INFORMATION.

1. Obvious differences between the Globe and Map.

The map is FLAT; the surface represented is SPHERICAL. In this lesson we learn how the map-maker is able to exhibit the various features of the globe on a flat surface.

The **Meridians** and **Parallels** only need be explained. The outlines of geographical facts are afterwards easily placed in position.

Comparison of Lines upon the Globe and Map.

GLOBE.	MAP.
(*a*) The **Meridians** are circles, and all pass through the Poles.	(*a*) Only the outside meridian in each hemisphere is a circle.
(*b*) The Meridians are all the same in size.	(*b*) The length of each meridian becomes less as they are taken from the outside meridian towards the centre of the map.
(*c*) The **Parallels** are circles passing round the globe, parallel to the Equator.	(*c*) None of the parallels are circles, and none are parallel to the Equator or parallel to each other.
(*d*) They become smaller as taken from the Equator towards the Poles.	

2. How the Map is obtained from the Sphere.

(*a*) Cut a sphere into halves, and pass the division through the Poles (Fig. 2).

(*b*) Each cut face will represent the flat surface upon which the meridians and parallels are to be drawn.

Note.—1. Each cut face represents a hemisphere as seen in a map of the world.

2. The outside meridian in each hemisphere exactly coincides with that on the globe.

3. Terms:—

The flat surface upon which the meridians, etc., are to be drawn, and which is represented by the cut face of each hemisphere, is called the PLANE OF PROJECTION.

When the meridians and parallels are drawn upon the plane, it is termed a MAP PROJECTION.

TEACHING NOTES AND ILLUSTRATIONS.

A globe with the meridians and parallels distinctly marked should be used along with a map of the world in hemispheres.

If possible obtain a skeleton globe with wires for the parallels and meridians.

Refer to the ordinary mode of map-drawing. After the parallels have been drawn, the other facts are readily inserted.

This comparison could be made by appeal to the knowledge of both globe and map possessed by the class, assisted by direct observation of the lines on the globe or map under the guidance of the teacher.

Fig. 1. Meridians and parallels as drawn on a map of one of the hemispheres.

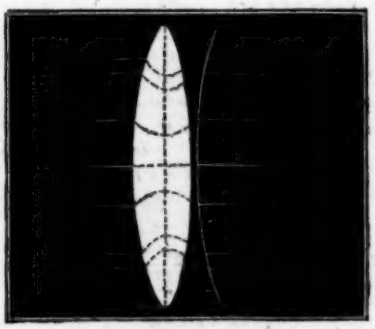


Fig. 2. A globe divided into two halves, showing one cut face.

(1) Cut an apple into two halves, the division passing through the stalk.

(2) Similarly an orange. Take off the rind; the cut circle of rind represents the outside meridian.

(3) Take a piece of paper and cut into a circular shape the size of the cut circle of rind, or the cut face of the sphere. This will represent the Plane of Projection.

See Figs. 1 and 4.

4. Parallels and Meridians.

α. Suppose the Plane of Projection to be transparent, and the parallels and meridians, seen by an eye, placed immediately over the centre, as in Fig. 3. Then :—

(a) The outside meridian on the projection and on the globe will be seen to coincide.

(b) The meridian half-way round from E. to Q., *i.e.*, 90° from E or Q., will be a straight line seen to cross the transparent plane at AOC.

(c) The Equator will also appear as the straight line EOQ.

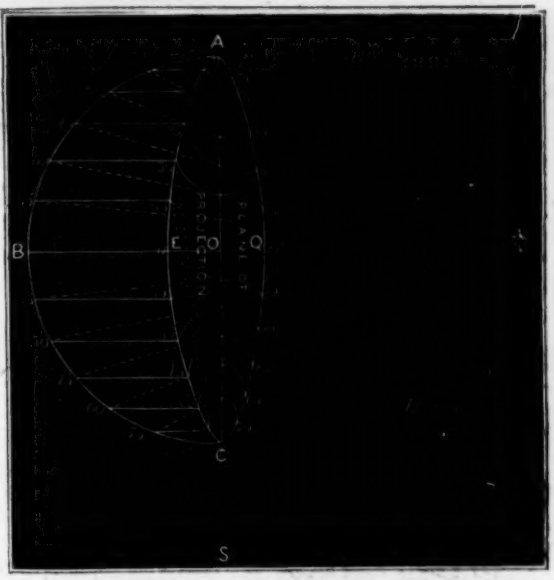


Fig. 3. Showing the projection of the parallels and meridians.

(b) By using a skeleton globe previously referred to, the meridian ABC would be seen to coincide with the straight line AOC.

(c) Similarly the Equator with the straight line EQ.

Allow several children to see this by taking the globe and making the observation.

β. The parallels will be found as follows :—

The 15th N. will run from 15° above E. to exactly the same distance above Q. We next find the point where this parallel crosses the central meridian AOC.

(a) This is done by drawing the dotted line from the point 15° above B to the eye. The point × formed by the intersection of the dotted line with the central meridian is the 3rd point through which the 15th parallel passes.

(β) This must be shown by means of the skeleton globe.

(a) If the class have a slight knowledge of perspective, the points of intersection will need very little help beyond the diagram.
If no perspective is known, take string and run it in the direction of the dotted lines.

γ. By 1st Grade Geometry the arc can be drawn passing through these three points—15° above E, 15° above Q and ×. **This arc is the 15th parallel.**

Similarly all the parallels may be drawn.

The skeleton globe, with wires for meridians and parallels, must be introduced to make this clear. With it the class will have no difficulty in seeing that the point of intersection made by drawing from 15 above E to S is the point through which the meridian 15° from AOC appears to pass.

A knowledge of 1st Grade Geometry will enable the scholar to draw the meridians when the three points through which each passes is found.

The remaining meridians are found as follows :—

Draw from 15° above E a dotted line to S, a point exactly the same distance from O as the eye, but in a direction at right angles to the direction of the eye. Where this dotted line crosses the Equator is the third point through which the meridian 15° from AEC passes. The other two points are the Poles.

Through these three points draw an arc of a circle. This arc is the meridian required. Similarly the 30th and other meridians may be drawn.

The complete projection would appear as Fig. 4

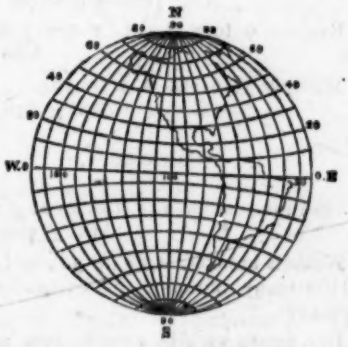


Fig. 4. Complete projection of parallels and meridians.

Recent Inspection Questions.

[The Editor respectfully solicits contributions—all of which will be regarded as STRICTLY PRIVATE*—to this column. For obvious reasons, it cannot be stated in which district the questions have been set.]*

Arithmetic.

STANDARD I. (DICTATED).

648	407	817
396	196	708
759	211	109
17		
981		
2801		

STANDARD II. (DICTATED).

(1) $38,296 \times 47 = 1,799,912$. Ans.

(2) $53,012 \div 6 = 8835$—2. Ans.

(3) From 50,010 take 48,001 = 2009. Ans.

STANDARD III.

(1) Divide 16,538,760 by 175.
Ans. 94,507—35.

Entirely in words

(2) Add together £75 16s. 8¼d., £308 19s. 7½d., £596 12s. 8d., £7408 9s. 10¾d., and £7769 10s. 0¼d.
Ans. £16,159 8s. 10¾d.

(3) From £10,001 5s. 1d. take £7769 10s. 0¼d.
Ans. £2231 15s. 0¾d.

(4) There are 14 desks in a schoolroom, and 5 children are sitting in each desk, and there are 7 children besides. How many children are there in the school? Ans. 77.

STANDARD IV.

(1) Divide £2009 18s. 10½d. by 36.
Ans. £55 16s. 7½d.—18.

(2) If I gave 22 boys 2s. 6d. each, and 18 girls 2s. each, and found I had 3s. 4d. left, how much had I at first? Ans. £4 14s. 4d.

(3) Reduce five hundred thousand inches to miles, etc. Ans. 7 miles 1568 yd. 2 ft. 8 in.

(4) Reduce 9 tons 8 cwt. 2 qrs. 7 lbs. 5 oz. to ounces. Ans. 337,909.

(5) Multiply £16 12s. 8½d. by 504.
Ans. £8383 14s. 6d.

STANDARD V.

(1) Find the cost of 122 articles at £2 10s. 8¾d. each. Ans. £309 8s. 11½d.

(2) Walnuts are sold at 28 for 3d., and apples 5 for 1d. How many walnuts ought I to exchange for 2½ doz. apples? Ans. 56.

(3) In 9 ac. 84 sq. yds. 2 sq. ft. how many square inches? Ans. 56,562,912.

(4) Make a bill for 23 yards of silk at 5s. 6d. per yard, 33 yards of calico at 11¾d. per yard, 2 dozen pairs of gloves at 2s. 7d. per pair, and 10 yards of ribbon at 1s. 10d. per yard.
Ans. £11 19s. 1¾d.

(5) If 195 men can do a certain piece of work in 8 weeks of 6 days each, in how many days would 78 men do the same work? Ans. 120.

STANDARD VI.

(1) Divide 9·2 by ·184. Ans. 50.

(2) Take $\frac{9}{64}$ from $\frac{1}{4}$, and give the answer as a decimal fraction. Ans. ·109375.

(3) In a school $\frac{1}{5}$ of the children are in the first class, and $\frac{1}{4}$ in the second class; there are 60 children in the other classes. How many children are there in the school altogether? Ans 96.

(4) If 14 men earn £31 4s. in 12 days, how much will 25 men earn in 8 days?
Ans. £37 2s. 10$\frac{2}{7}$d.

(5) Find by practice the cost of $\frac{3}{4}$ ml. at £3 18s. 6$\frac{1}{2}$d. per yard. Ans. £5185 2s. 6d.

ADDITIONAL FOR EXAMINATION.—STANDARD VI.

(6) Find the simple interest on £380 for 2½ years at 4 per cent. per annum. Ans. £38.

Geography.

STANDARD II.

The definitions, with *examples*. Questions were asked respecting—the proofs of the earth's rotundity, a watershed, bed of a river, estuary, tributary, promontory, circumference, diameter, and axis.

STANDARD III.

Rivers, islands, lakes, ports, mountains, hills (with names of highest summits) and industries of England.

STANDARDS IV., V., VI.

Scotland.—Divisions, capes, openings on W., and towns, mountains, lakes.

Australia.—Divisions, capitals, rivers, mountains.

I dia.—Rivers, towns, mountains, special reference made to Punjaub, and why so called.

Animal Physiology.

FIRST YEAR'S COURSE.

(1) Name the chief organs in the thoracic cavity, and give their position.

(2) Explain the terms, flexors, extensors, rotators.

(3) What are the ribs, and what cavity do they help to enclose.

(4) Name the bones of the arm and leg.

(5) Show from the structure of the body that man was intended for an upright position.

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR JUNE, 1883.

EXERCISE XXI.

(1) $12x^2y^2z$; $45a^2b^2cd$.
(2) $240a^2b^2cdef$; $216a^2x^3y$.
(3) $12a^2b^2x$; $60x^2y^2z^2$.
(4) $a^4b^3c^5d^3$; $96m^2n^2p^2qr^2$.
(5) $1320a^2b^3m^2xy^2$; $240a^2b^3cd^3$.
(6) $36(a+b)^2(a-b)^2$.
(7) $48m^2n^2(a+x)(a-x)$.
(8) $30a^2bc(x+y)^2(x-y)$.
(9) $20x^2y^2(y-3x)$.
(10) $18(m-n)^2(m+n)$.

EXERCISE XXII.

(1) $(a+2)^2(a+3)$.
(2) $(a+2)(a-3)(a-4)$.
(3) $(x+1)(x-1)(x-2)^2$.
(4) $(x+1)(x-1)(x^2+1)(x^2-x+1)$.
(5) $(a+1)(a^2-a+1)$, that is, (a^3+1).
(6) $(x+2)(x-6)(x-7)$.
(7) $(x+1)(x+2)(x+3)(x+4)$.
(8) $36(a+2)(a+3)(a+4)$.

ANSWERS TO ARITHMETICAL QUESTIONS IN THE 'SCHOLAR' FOR JUNE, 1883.

STANDARD IV.

A. 1. £823 19s. 8¾d.
2. 8,960,000 ozs.
3. £45 18s. 3¾d.—2.
B. 1. £144 1s. 1¾d.
2. £600 19s.
3. 10,841,600 sq. yd.
C. 1. 212 ton 1 cwt. 3 qrs. 16 lbs. 11 ozs.
2. £382 11s.
3. £8 19s. 11½d.—8745
D. 1. 60 dys. 18 hr. 20 m.
2. 24,000 pints.
3. 23,273,376 ozs.
E. 1. 246,893 min.
2. £1 4s. 7¾d.
3. 17 c. yds. 14 c. ft. 91 c. in.
F. 1. 718,740 sq. ft.
2. £4198 12s. 10¾d.
3. £146 5s.

Advanced Examination.

1. £1 10s. 8d. gain.
2. £216.
3. 3½ days.

STANDARD V.

A. 1. £220 10s.
2. £1 3s. 7½d.
3. 2¾.
B. 1. £2020 17s. 3⅜d.
2. £2621 19s. 6¼d.
3. £3 16s. $6\frac{9}{10}$d.
C. 1. £12 6s. 2d.
2. £236,564 1s. 3d.
3. $3\frac{3}{17}$.
D. 1. £16 17s. 7½d.
2. 127 books.
3. £161 10s. 9½d.
E. 1. $1\frac{7}{19}$.
2. £93 2s. 5d.
3. 5 miles.
F. 1. £238 19s. $10\frac{8}{11}$d.
2. 4 ac. 27 per.
3. £4347 1s. 9¾d.

Advanced Examination.

1. Boy 7s. 6d., w. 10s., m. £1
2. £28,536 5s.
3. £295 4s. 8d.

STANDARD VI.

A. 1. £26 0s. 8d.
2. $\frac{23}{24}$.
3. ·00000546875.
B. 1. £385 13s. $5\frac{1}{19}$d.
2. ·000035.
3. £41 15s. 2¾d.
C. 1. 21 tons.
2. ·84.
3. $\frac{5\frac{1}{2}}{7\frac{4\frac{1}{2}}{11\frac{2}{3}}}$
D. 1. £3398 8s. 9d.
2. 4s. $11\frac{1}{13}$d.
3. £21 12s. 9·216d.
E. 1. $\frac{1\frac{1}{2}\frac{1}{3}}{2\frac{1}{3}\frac{1}{5}}$ week.
2. $4\frac{1}{4}\frac{1}{7}$
3. $362\frac{1}{2}\frac{1}{4}$ days.
F. 1. 1s. $7\frac{1}{11}\frac{1}{13}$d.
2. 2s. $9\frac{1}{6}\frac{1}{7}$d.
3. £11 16s. $11\frac{2}{11}$d.

Advanced Examination.

1. $7\frac{1}{2}$ per cent.
2. 12 to 5 (man to boy).
3. £8 9s. 1·26384d.

STANDARD VII.

A. 1. 10s. $3\frac{1}{2}\frac{1}{3}$d.
2. $63\frac{1}{3}$ per cent.
3. 12 per cent. gain.
B. 1. £39 6s. $10\frac{8}{21}$d.
2. 1,010,100.
3. $6\frac{1}{7}\frac{1}{9}$ loss per cent.
C. 1. £27 18s. $1\frac{8}{9}$d.
2. $35\frac{5}{7}$ per cent.
3. $\frac{1}{12}$d. (or) ·38d. each.
D. 1. 11s. $2\frac{1}{3}$d.
2. £6 13s. 4d.
3. 7s. $10\frac{8}{1\frac{8}{6}\frac{7}{7}}$d.
E. 1. 9,992,500
2. £36 18s. 1½d.
3. £1459 7s. 6d.
F. 1. 103 av., $93\frac{7}{11}$ p. c.
2. $49\frac{1}{3}$ per. cent. gain.
3. £41 8s. $6\frac{6}{7}$d. gain.

Advanced Examination.

1. September 8th.
2. £25,000.
3. £188⅔.

SOLUTIONS OF THE ADVANCED EXAMINATION QUESTIONS IN 'THE SCHOLAR' FOR JUNE, 1883.

STANDARD IV.

1. $112 \times 3\frac{1}{2} = 392$ lbs. 4d. $\times 392 = 1568$d. = £6 10s. 8d. £6 10s. 8d. − £5 = £1 10s. 8d. gain. Ans.

2. As 7 sheep are worth £30, 21 sheep are worth 3 times as much, or £90. But this is the price also of 5 cows, hence £90 ÷ 5 = £18, price of one cow, which × 12 = £216. Ans.

3. 4s. 9d. × $22\frac{1}{2}$ = £5 6s. $10\frac{1}{2}$d. wages for full time. £5 6s. $10\frac{1}{2}$d. − £4 10s. 3d. = 16s. $7\frac{1}{2}$d. wages lost. 16s. $7\frac{1}{2}$d. ÷ 4s. 9d. = $3\frac{1}{2}$ days. Ans.

STANDARD V.

1. As a woman receives 2s. 6d. more than a boy, and as a man receives twice as much as a woman, a man gets 2 boys' shares + 5s. First giving the men their extra 5 shillings, 5s. × 20 = £5; and the women their 2s. 6d., 2s. 6d. × 24 = £3, total £8. Then £47 − £8 = £39 still for distribution among the 84 recipients, but as each man gets *two* boys' shares, £39 ÷ 104 = 7s. 6d. boy, 10s. woman, and £1 man. Ans.

2.

					£	s.	d.
400 bales, each	350 lbs., at	10½d.	a lb.	=	6125	0	0
660	,, 300	,,	10½d.	,,	= 8456	5	0
480	,, 320	,,	9½d.	,,	= 6080	0	0
720	,, 300	,,	8½d.	,,	= 7875	0	0
					£28536	5	0

3. 3 cwt. 64 lbs. = 400 lbs., and £3 10s. 10d. ÷ 400 = 2½d. a lb. 14 ton 17 cwt. 80 lbs. = 33344 lbs., which, at 2½d. a lb. = 70856d. = £295 4s. 8d. Ans.

STANDARD VI.

1. (£1 17s. 6d. ÷ 5) × 12 = £4 10s. a year's interest of £60. £100 is ⅔ of £60, hence (£4 10s. × 5) ÷ 3 = $7\frac{1}{2}$ per cent. Ans.

2. 8 × 5 × 10 = 400 hours' work for a man.
20 × 6 × 8 = 960 ,, ,, boy.
Hence their ability is in the inverse ratio of 400 to 960, that is 960 to 400 = 12 to 5. Ans.

3. 6·15 c. ft. × 24 × 2·85 × 120 = 50479·2 c. ft. = 50·4792 *thousands*. Then 3·35s. × 50·4792 = £8 9s. 1·26384d. Ans.

STANDARD VII.

1. £800 ÷ 25 = £32, a year's interest. Bringing £12 16s. to the fraction of £32, we have ⅜; hence it is ⅜ of a year's interest = 146 days, which, from April 15th, gives September 8th. Ans.

2. Every £100 insured must include £1 10s., the rate of insurance. That is, every unit of £98 10s. in the value of the ship must be insured for £100. Then £24625 ÷ £98 10s. = 250 *hundreds* = £25,000. Ans.

3. As £100 is to make £4½ interest, the principal that will make £8½ interest will (bringing both to £½) be $\frac{1}{9}$ of £100 = £188⅔. Ans.

ANSWERS TO ARITHMETICAL QUESTIONS IN THE 'LITTLE LEARNER,' FOR JUNE, 1883.

STANDARD I.

A. (1) 106
(2) 161
(3) 249
B. (1) 917
(2) 887
(3) 2,226
C. (1) 1,178
(2) 2,329
(3) 1,807
D. (1) 134
(2) 773
(3) 126
E. (1) 212
(2) 383
(3) 187
F. (1) 377
(2) 95
(3) 85
G. (1) 4,269
(2) 13,936
(3) 24,231
H. (1) 2,569
(2) 896
(3) 79
I. (1) 20,283,224
(2) 713 marbles
(3) 43 eggs
J. (1) 45,301,535
(2) 2,954
(3) 64 men

STANDARD II.

A. (1) 81,206
(2) 138,960
(3) 303,974
B. (1) 22,432
(2) 47,718
(3) 3,998
C. (1) 1,009,104
(2) 2,819,350
(3) 70,744,500
D. (1) 4,079,385
(2) 5,508,512
(3) 39,022,480
E. (1) 200,804,063
(2) 725,740,470
(3) 2,718,901,878
F. (1) 17,898
(2) 4,094
(3) 2,544+1
G. (1) 9,254
(2) 10,063+6
(3) 7,565
H. (1) 5,157+64
(2) 1,802+6
(3) 3,579
I. (1) 156,914,520
(2) 1,598 pounds
(3) 48,307 farthings
J. (1) 1,304
(2) 5,209 gross
(3) 672 walnuts

STANDARD III.

A. (1) 2,473
(2) 998+5
(3) 976+63
B. (1) 3,806
(2) 9,304+63
(3) 1,089
C. (1) 29,194+201
(2) 15,790
(3) 8,006
D. (1) 5,480+506
(2) 6,305
(3) 10,139+5,006
E. (1) £30 16s. 6d.
(2) £199 14s. 1½d.
(3) £1,228 14s. 10½d.
F. (1) £14,115 2s. 7d.
(2) £15,970 0s. 9½d.
(3) £182,833 19s. 5¾d.
G. (1) £68 17s. 5d.
(2) £628 4s. 9½d.
(3) 13s. 9½d.
H. (1) £2,347 19s. 11½d.
(2) £782 5s. 8¾d.
(3) £5,972 13s. 8½d.
I. (1) 296 leaves
(2) £3 12s. 4½d.
(3) 72 pounds
J. (1) 4s. 6d.
(2) 207
(3) £10 8s. 4d.

—o—

Swiss Education.

BY CHARLES MANSFORD, B.A.,
Vice-Principal of the Westminster Training College.

THERE is probably no nation in the world whose system of primary education has been so highly extolled as that of the Swiss. Every public speaker on the subject, from the Vice-President downwards, is loud in his praises of the Swiss system and its results, which he regards as a standing rebuke to our national parsimony and stupidity. We are wealthy and ignorant, while Switzerland, we are told, is one of the poorest and best educated countries in Europe.

If we look to the past educational history of the two countries, no doubt both the praise and the blame are well deserved, but whether they are entirely just and discriminating at the present moment may be very fairly questioned. Before accepting this estimate of our relative positions, one would like to know a little more precisely the grounds on which it rests. Especially is it important to inquire whether our censors have not fallen into the error of concluding that all the States of the Swiss confederacy stand on the same educational footing and are regulated by the same educational laws. Even if this were true, we ought still to be on our guard against adopting the educational condition of such towns as Basel and Zurich as a standard applicable to the entire country. But as a matter of fact, Switzerland for educational purposes consists of twenty-five States, each of which has an education department of its own. By the new federal constitution voted in 1874 education is everywhere free and compulsory, but each canton frames and administers its own code of regulations for teachers, scholars, and committees. The amount of instruction therefore varies enormously in different cantons; and while the average education rate for the entire confederacy is about 1s. 4d. per head, in the city of Basel it is 5s. 10d. per head, and only 2½d. per head in the canton of Unterwalden. Facts like these, which lie on the surface, should lead us to receive general observations on the subject of 'Swiss Education' with extreme caution, lest we should be ascribing to the system, as a whole, a degree of success which has only been attained in special and favourable instances.

Such startling variations as those just indicated naturally awaken the desire for further information, and lead us to ask ourselves what the educational condition of the confederacy, as a whole, really is. This is a question which it is very difficult to answer. In this country we should naturally turn for guidance on such a subject to the Annual Report of the Education Department. But in Switzerland there are twenty-five such departments, each with its own local report, and hitherto no attempt has been made officially to combine them in such a manner as to present a report of Swiss education in general. In short, there is no educational Blue Book published for Switzerland; and the only sources of information are the twenty-five local reports published by the cantons. To examine such an array of documents, even cursorily, is a serious undertaking; and when it is further discovered that of the reports published in any one year some refer to the current and some to the previous year, while some are biennial and others triennial reports, the task becomes truly formidable. But private enterprise has at length undertaken what the official authorities had failed to do; and I have lately had put into my hands a digest of the local educational reports for the year 1878, written and published by Herr Grob,* secretary to the Education Department for the Canton of Zurich. This publication may indeed be regarded as an attempt, apparently the first of its kind, to present a general report of the Swiss system of education as a whole. It contains an abstract of each of the local reports, a summary of the laws and regulations promulgated or revised in each canton during the year, and lastly, a comparative view of the condition and progress of education in the various States arranged under definite heads. The reports on which this review is founded are confessedly fragmentary, immethodical, and written from various standpoints. Moreover, they are altogether silent on many details of importance, and naturally take for granted what an outsider is most anxious to learn—viz., a knowledge of the special laws and regulations which prevail in the several cantons to which they refer. But they are official and reliable, and they bring into prominence those aspects of the work which the local departments deem to be of greatest importance for the canton. We can have no difficulty therefore in learning what the Swiss inspectors think about the working of their own system. The comments of these gentlemen, together with the statistics and details they report, will reveal to us the condition of primary education in the several districts, while under Herr Grob's competent and intelligent guidance we may learn how to combine these particulars in one general view, and so infer with proximate accuracy and completeness the educational condition of the country as a whole. Thus instructed, we shall be better prepared to estimate our

* Berichterstattung über das schweizerische Unterrichtswesen auf Grundlage der im Jahr 1878, erschienen offiziellen Jahresberichte von K. Grob, etc.

own relative position, and to receive such direction as our Swiss guides are able to give. It will be convenient to follow Herr Grob's division of the subject as nearly as possible, and we therefore begin with school attendance.

I.—SCHOOL ATTENDANCE.

(*a*) *Obligatory School Period.*—In general, the compulsory attendance at school commences with the eighth and closes with the fourteenth year of the child's age, thus covering a period of seven years. But there are considerable variations both as to the extent and contents of the obligatory period in the different cantons. In at least three of the cantons the school course includes only six years, and in others again it extends to nine years; but nowhere is attendance at the elementary school required before the seventh or after the fifteenth year.

The number and length of the attendances are varied according to the character of the district and the occupations of the people, so that the number of years prescribed fails to give a correct idea of the time actually spent in school. There are many half-time schools, and very many which are closed for several months in every year. In Aargau and Wallis, the legal school period is identical as to length, but the contents are widely different. The eight years prescribed in Aargau are complete years, with a minimum attendance of twelve hours a week in summer and twenty-four in winter. In Wallis, on the contrary, the annual period spent in school amounts only, on the average, to six months. Again, in Glarus, St. Gallen, and Basel, the school course covers seven complete years. But the results must be widely different, since in Glarus instruction begins a year earlier than in the other two. In St. Gallen only about half the schools are open all the year round. Further, children attending half-time schools in this canton must compensate for the loss by attending a year longer, which is not the case in Glarus. Finally, the seven years in Basel include four years in the commercial schools which here constitute a special class. It appears from Herr Grob's report that the schools generally are open a much less number of times in the summer than in the winter months, and that in one-third of the cantons they are either closed altogether for certain months in the year, or have only one meeting per day.

A large proportion of the schools have only one teacher. These are called 'gesammt schulen,' or undivided schools. Such schools may contain eighty pupils, although a large proportion of them contain more, and they are taught by *one* teacher, all the classes being taught at the same time. When more than eighty children are in attendance, a second teacher is appointed, and the school is termed a '*getrennt schule*' or 'divided' school. Of course an additional teacher is appointed for every eighty children in attendance. The proportion of undivided to divided schools in the canton of Zurich is about seven to three, the precise numbers being 254 of the former and 109 of the latter. Of these, fifteen undivided schools contain more than eighty children, and forty-seven classes in the divided schools are similarly situated.

The number of classes in a school is generally identical with the number of years in the school career. Promotion takes place annually, when it is justified by the progress and ability of the pupil. It follows that many of the children leave school before reaching the upper classes. In the canton of Solothurn, out of 1846 pupils attending the evening schools (attendance at which is compulsory), 446, or one in four, had never attained to the upper standard. Further, it not unfrequently happens that children are excused the last two years of the school course altogether, either because they are sick, or hopelessly dull, or on account of the poverty of the parents.

From these particulars it is clear that any comparison of the school periods prescribed in this country, and in Switzerland generally, must be altogether fallacious as a means of estimating the relative amount of time spent in school, and equally misleading as a measure of the relative amount of instruction given in the two countries.

(*b*) *Pupils.*—Four of the cantonal reports omit any mention of the number of children actually attending school. In these cases an estimate is made, founded upon the census of the population and according to the limits of the school law. In all other cases the precise figures are given, and the number attending the primary schools is thus found to be 429,689, which is only 30,000 short of one-sixth of the entire population. Since the number in the secondary schools is just over 30,000, it is certain that one-sixth of the population is attending school. In Geneva and Basel the numbers reported fall far below the estimated amount, viz., one-sixth of the population; but whether this is owing to the presence of a 'wastrel' element in the population, or to the fact that the population consists largely of visitors and foreigners, I am not able to determine. In nine other cantons there is a deficiency less marked in the number of pupils, while in twelve cantons the numbers are in excess of one-sixth of the population.

It should be remembered that these numbers represent the muster of children on the school-roll and not the average attendance. Comparing them with the corresponding numbers for England and Wales, as given in the last Blue Book, I find that they represent precisely the same per centage of population, viz., 15·5. Since the school age begins two years earlier in England than in Switzerland, the average age of the Swiss pupils is greater than in this country, and there is also a greater proportion of children attending the higher standards. But Switzerland has very few large towns. Every child is under the immediate and effective supervision of the legal and school authorities, and the value of education is and has long been everywhere highly appreciated. With all these advantages, and a free system of education to boot, it is satisfactory to find that, in regard to the number of children on the school-roll, we are not one whit behind even this model country of Switzerland.

(*c*) *Absentees.*—The character of the attendance is somewhat difficult to determine, from the fact that it is not quite clear whether the reporter means by an 'absence,' in each case, a day or half-day absence. And when this point is settled, the limits of justifiable or punishable absence vary so widely—not only in different cantons, but in different parts of the same canton—as to render the statistics for the purpose of comparison practically worthless. Even where the letter of the law is the same, the stringency with which it is enforced depends, in the first instance, upon the zeal of the local authorities in putting it in operation; and, next, upon the interpretation they chose to put upon it. And that many of the school committees are remiss in the

discharge of their duties in these particulars is evident from the fact that, in the canton of Bern, the annual grant was withheld from seventy parishes during the year, because 'they had neglected, in spite of repeated warnings, to make the attendance returns required by law to the Education Department.' In the same canton there were also nine parishes whose school committees had neglected throughout the year to enforce the law against absentee children. Among the causes assigned by the inspectors for irregular attendance, none are more frequent than those which refer to the indifference and negligence of the local committees.

Where teachers and officers faithfully discharge their duty,' says the inspector from Basel-land, 'the school attendance is regular, but where they are indifferent the attendance is anything but satisfactory.' The number of defaulters handed over to the judicial authorities during a year (in a canton in which the law is laxly administered) was 159. Even in Neuchatel 'many of the children are excused on wholly insufficient grounds, and the committees fail to warn negligent parents, or to accuse the refractory before the magistrates.'

Another cause assigned for irregular attendance is the indifference or indigence of the parents. Much as the Swiss value education, they still need to be frequently and urgently reminded of their duty to their children; and a considerable proportion still require the firm and continuous application of the compulsory law. The inspector in Obwalden remarks that 'the duty of regular attendance at school requires to be much more thoroughly wrought into the conscience —into the flesh and blood of both parents and children.' Again, the poverty of the parents in many districts is an obstacle in the way of good attendance, since they are unable to live without the earnings of their children, and are too poor to pay the fines imposed upon absentees. In the canton of Geneva, most of the parents summoned for neglect of duty in this particular, excused themselves on the ground of their straitened circumstances; and in this and other cantons it is usual, under such circumstances, to dispense with the last two years of school attendance altogether.

Bad teachers and inadequate apparatus are, in some instances, pleaded as a reason for irregularity; and the districts are few in which there are not complaints on this head, from one cause or another.

It is difficult, however, to get at very precise results, and even the complaints themselves may not be so unfavourable as they at first sight appear to be. Everything depends upon the standard adopted, and the rate of attendance, which would appear high in one place, and under one set of circumstances, may seem very low in another. The statistics given on this head point in totally different directions, and seem to be irreconcilable with each other. In Solothurn, the number of defaulters fined by the magistrates amounted in the year to 2779, against 3453 in the previous year, which is just twenty-three per cent. of the total number on the cantonal registers. But in the table showing the average number of absences per child for the canton of Solothurn, I find it amounts to 19·2. The only explanation seems to be that the schools are not open nearly so many days as in England, and that 19 is a large percentage of the number of school meetings. In Tessin, 572 school children, out of a total of 18,000, could give no satisfactory account of their absence from school; and in Vaud there are schools in which, during the summer-time, no child is to be found over twelve years of age. In the same canton the school committees allow children to make 150 absences in the year without inflicting fines or punishment. In Wallis, the state of school attendance is so bad as to constitute 'an open sore.' These figures suffice to show that the committees in Switzerland have to deal with the same difficulties which beset the School Boards in this country, although the absence of large towns, with their shifting masses of population bordering on pauperism and crime, enables them to deal with them more successfully than is at present practicable in our own towns.

The following figures show the average number of absences per scholar in twelve cantons for the year 1877-78:—

Zurich,	15·9	Uri,	14·2	Freiberg,	19·7	Aargau,	13·7
Bern,	27	Schwyz,	14	Solothurn,	19·2	Thurgau,	13·8
Luzern,	14	Obwalden,	11·9	Basel-land,	24·4	Vaud,	31·2

The average is eighteen.

In comparing these results with the average attendance in England, it is proper to remember that the schools in Switzerland are not open nearly so many weeks in the year as in England: that the attendances, as a rule, are shorter than in this country; and that children who have obtained temporary leave of absence from the school authorities are, in Switzerland, removed for the time being from the school register altogether. Still, when all these allowances have been made, it remains that the attendance is much more continuous and regular in Switzerland than in our own schools. In a few instances the statistics enable us to calculate what percentage the numbers above-given are of the entire number of school days. This percentage for the canton of Uri—where the average number of school-days is 136—is ten and a half or five and a quarter, according as the absences reported are half or all-day absences. In the former case the average attendance amounts to eighty-four, and in the latter to ninety-four per cent. of the children enrolled, whereas in this country the average attendance is barely seventy-one per cent. of the children on the registers. This puts our deficiency in a startling light, and shows that neither parents, committees, nor teachers perform their duty in this matter with anything like the zeal manifested in Switzerland. Moreover, in that country, the most strenuous efforts are being made to improve the attendance. The school committees are being compelled by the central authorities to put into more vigorous operation the powers vested in them by the law; the parents are everywhere waking up to a more just sense of their obligations; and the character of the teaching is rapidly improving. By these, and other methods they are striving to bring every child regularly and continuously to school; and I see that already, in the canton of Zurich, the unexcused absences amount, on an average, to less than one per child for the entire year. These results have not been attained without long and painful struggle on the part of all who co-operate in the work, and although we are rapidly gaining ground, it must be confessed that our average attendance compares very unfavourably with that of the Swiss, and that we are still far behind them in our appreciation of the value of education, and in the extent of self-denial we are prepared to make for it.

II.—TEACHERS.

From the pupils I turn to the teachers, with reference to whom the statistics are so imperfectly pre-

sented in the reports, that the number employed has to be estimated in *eleven* cantons by allowing one teacher for each class in the graded schools, and one for each ungraded school. For the remaining cantons the precise numbers are given; and the total thus obtained amounts to 7963, or one teacher, on an average, for every fifty-four children on the school roll. A similar calculation for England and Wales gives one teacher for every fifty-four children on the registers. But this includes pupil-teachers, whereas every teacher in Switzerland is a certificated teacher. The proper method of estimating the relative teaching power employed is, however, to compare the number of teachers with the average attendance; and this calculation gives one teacher for every forty in England, and one for every fifty in Switzerland. Looking to the regulations in each country, I am inclined to think that the English schools are, and are likely to be, in the future better staffed that the Swiss schools. The pupil-teacher system lends itself very readily to the case of the small schools numbering from sixty to 100 children. Such a school, under the English code, would be taught by a teacher and a pupil-teacher. But in Switzerland the principal teacher counts for eighty instead of sixty as with us, and when the numbers lie between eighty and 100 the increased cost of the additional teacher is so great that the parishes refuse to incur it. The same cause operates to prevent the employment of additional teachers in all schools where the numbers, when divided by eighty, give a small remainder; and taking even such a canton as Zurich, there are forty-seven schools out of 109 where a single teacher has charge of more than eighty children. In the outlying cantons matters must be worse.

The proportion of mistresses to masters is about one to two, and it is largely increasing. In twelve cantons, for which the details are given in the reports, while the number of masters in the previous four years had diminished by sixty-six, the number of mistresses in the same period had increased by 416; and further examination shows that this increase was contributed, almost without exception, by the religious sisterhoods. Also there has been a similar though less considerable increase in the number of clericals employed as masters; and the inspector in the canton of Uri thinks it would be beneficial if celibates were universally employed, since the schools are too poor to maintain married men, and demand teachers who will not shrink from self-denial. This consideration may have had something to do with the large increase of the ecclesiastical element on the teaching staff, since the pay of the lay-teacher is always greater than that of the clerical. But in the case of the sisters, the increase is due also to other causes; and its explanation is to be found in the fact that the women make better teachers than the men. They are, as a rule, more zealous, more devoted, more punctual in the fulfilment of the regulations, more obedient to the committees, and finally, more successful as disciplinarians and instructors.

With all this, however, it must still be said that the women are not so faithful to their vocation as the men, and that the *personnel* of the female staff is not so stable and constant as that of the male staff of teachers. The statistics given for the cantons of Bern and Vaud show that while one-quarter of the masters and one-half of the mistresses have been in the service less than five years, after a further period of ten years the proportions are reversed, and one-half of the masters, but only one-quarter of the mistresses, have remained fifteen years in the work. The rate of increase in the teaching staff may be inferred from the number of certificates granted in a year, which amount to more than 600.

The economical position of the teacher is frequently referred to in the local reports; and from these notices I gather that in the more prosperous cantons the average pay of a teacher varies from £50 to £60 a year, with house, garden, and supply of wood, valued altogether at £8 a year. In other districts this is less, but only one canton is mentioned in which it is more. The highest salary mentioned is in Aargau, where at least one fortunate teacher receives £96 a year. The lowest is in Uri, where one unfortunate wight receives a pittance of £4 per annum in money, which the parish is too poor to increase. In the canton of Wallis the average salary is £12 a year, which is not always punctually paid.

The social position of the teacher, however, is not so low as these figures might suggest. The pay of the school inspector is only £160 a year; and relatively to the cost of living and general condition of the people, the Swiss teacher who has an appointment in town, or in the more prosperous cantons, is in a position quite as comfortable as an English teacher. In some respects he is even better provided for. Nearly every canton has its Teachers' Superannuation Fund, to which the State liberally contributes. Subscription to this fund is compulsory both upon the parish and the teacher; and from its resources retiring allowances are granted, after twenty years' service, varying from £16 to £30, and amounting, in fact, to half-pay. Proportionate pensions are paid to widows and orphans on the death of the father, grants are made in cases of sickness; and, in general, the State pays for a supply. The teacher is therefore honourably cared for in Switzerland; and if the pay of the English teacher is higher, it is only a just *and inadequate* compensation for the more arduous toil demanded of him, and the more desperate struggle forced upon him in this country to maintain his family and provide for the contingencies of sickness and the certainties of old age.

Teachers in general are trained in seminaries, in which a special course of instruction is provided for them ranging over three years. Other pupils, besides candidates for teachers, reside and are educated at these institutions, which stand in closer alliance with the secondary than the primary system of education, and more nearly resemble an English boarding-school than a training-college. The subjects taught are the usual school subjects, and the final examination in canton Freiburg, *e.g.*, includes religion, French, Paidogogy, arithmetic, Swiss history, and geography. In other cantons there is required a knowledge of two modern languages, of elementary science, and of the principles of agriculture and forestry, together with music and drawing. Candidates may have their expenses (£16 a year) paid by the State; but in that case they must pass the examinations satisfactorily, and agree to serve the canton ten years, or otherwise refund the money. No teacher can be appointed to a school unless he satisfies the Cantonal Examination Committee of his competency. This committee in Aargau, *e.g.*, consists of three members, who examine the credentials of any teacher coming from another canton, and have the

power to put every candidate through a written, oral, and practical examination. If this is satisfactorily passed, the patent or certificate is granted conditionally; but it is not made absolute for all localities until after a service of about eight years. It is impossible to tell what proportion of the Swiss teachers have received a special training for their work, and it is equally difficult to get at the standard of attainment required by the examination committees. One thing is clear in this department as in every other department of Swiss education—viz., that there are varying standards for different cantons; and the general impression left upon any one who studies the reports is that the teachers are not overtrained, and that very many of them are but poorly equipped for their work.

The same conclusion is forced upon one by the provisions made for the completion of the teachers' education after they have entered upon their work. In many of the cantons special courses of instruction are organised at certain centres, which all the teachers are bound to attend either on Saturday afternoons or during the summer holidays. The lecturers are paid by the State, but the teachers bear their own charges. The instruction given consists of a revision of the school course, or of some one subject of school instruction, and lessons in school management, accompanied by criticism lessons. These arrangements, and the fact that in many districts teachers must find some other employment for considerable portions for each year, point to the conclusion that the education and training of teachers in Switzerland are not so complete and satisfactory as they ought to be.

From the pupils and teachers I pass to the instruction given in the schools.

III.—Instruction.

(*a*) *Day Schools.*—The 'standards' of instruction prescribed in the primary schools vary considerably in the different cantons, and those adopted in the towns are generally of a higher grade than the corresponding standards for the country districts. The subjects taught are language, writing, arithmetic, singing, and drawing, geography, and history. Drawing commences with the third school year; geography and history, which are limited in their application to Switzerland, are introduced in the fourth school year. The other subjects are taught from the beginning. In a few cantons the geography of Europe, the elements of natural science, and an outline of European history are added to the curriculum; but the time devoted to them is necessarily very limited.

In *Arithmetic* the teaching is greatly facilitated by the employment of decimal standards. The tables being thus graded on a decimal system there is no distinction between simple and compound rules, so that commercial arithmetic is introduced from the beginning as an immediate application of ordinary computation to concrete examples. The instruction at each standard naturally falls, therefore, into three stages—viz., mental, theoretical, and practical. In the first year these computations are limited to the numbers lying between one and twenty, and in the following years they are gradually extended first to 100, next to 1000, and in the fourth year to 10,000. This enables the teacher fully and thoroughly to develop the underlying principles of arithmetic, and to make the processes of arithmetic a means of mental discipline instead of mere rules of thumb. It also blends the theoretical with the practical from the outset, and thus imparts an interest and utility to every calculation made. At this point (the fourth or fifth year), the national coins are introduced, and the measures of length and weight follow, together with the principles of vulgar fractions. In the sixth year, calculation, both with vulgar and decimal fractions, is required. The rule of three is also added with its applications to interest; and finally, in the seventh year, the pupil is taught the elements of mensuration and perhaps book-keeping.

The standards for *Language* include reading, recitation, dictation, grammar, and composition. A large share of the school time is devoted to this subject, and great pains are taken to make it disciplinary and educative. For this purpose every step—at least in many of the cantons—is prescribed in the code with great minuteness of detail, which is not confined to the subjects merely, but extends to the methods, and even to the books, or parts of books, to be used. Indeed, the code in such cases is a manual of method as well as a standard of attainment, and furnishes a complete programme for both teacher and pupil at every stage of the subject.

Into the particular details of these standards I do not propose to enter, as they lie out of my present line of inquiry. I may remark, however, that they offer a striking contrast to our standards, which are concerned with results merely, while the Swiss regulations leave the impression that methods are the more important part of education. In this sphere, however, everything depends upon the intelligence and skill of the teacher, whose special business it is to know what are the best methods for the attainment of the true ends of education, and how they are to be applied under given circumstances. To such a teacher a stereotyped programme of work and method must be useless and embarrassing, and it may be doubted whether to an unqualified teacher such fixed rules can be of very great service. But, passing by this question and looking to the standard of attainment aimed at, I do not find it materially different from that prescribed in the English code under the heads of reading, writing, and the first class subject, 'English.' Indeed, these corresponding portions may be said to cover the same ground.

The standards for geography and science are decidedly lower than in the English code; and although singing and drawing are prescribed from the first in Switzerland, they are very imperfectly taught, and in some of the cantons they are entirely neglected. Gymnastics, on the other hand, are more vigorously cultivated, and are becoming a favourite branch of instruction, especially in the towns.

In looking to the results of instruction, as reported by the inspectors, it is somewhat remarkable to find that the one subject singled out everywhere for complaint is that of language. From every quarter there are loud laments over the barren character of the instruction in all three of the national languages of Switzerland.

The inspector in the canton of Schwyz, in commenting on the teaching of language, remarks that 'Since a child can only be said, properly speaking, to know that which he can express, and can only remember permanently that which he has intelligently wrought out, every pupil ought to be taught to think and speak for himself. The "leading strings" in

which children are perpetually led should be done away, and they should be encouraged to stand on their own feet.'

In Thurgau, the inspector finds a marked absence of all those scientific methods which are so minutely defined in the detailed standards, and the teaching, in his judgment, is 'mere memory-cram, without consistency and stability.'

The children in Ticino, on leaving school at fourteen years of age, 'have so little command of their mother-tongue, that it is only with the greatest difficulty they are able in any wise to put their thoughts on paper.'

In Geneva, again, we read that 'the children lack ideas; and what few they possess they can neither arrange nor express.'

These examples, taken in turn, from German, French, and Italian Switzerland, show that the teaching of language is not, on the whole, more successfully prosecuted than in England; and it is interesting to notice the general reason assigned for this unsatisfactory result. That reason is ascribed by both teachers and inspectors to the fact that the programme of instruction is too ambitious, and the number of subjects too great. In Zurich, in particular, the teachers contend that the first three years of school life, from seven to ten, should be limited to elementary lessons on the three R's, and the medical men join them in the demand that for the same period slates only should be used for writing and drawing. Even in the higher classes they plead for a limitation of subjects, and a more thorough treatment of fundamentals.

In other quarters the failure is attributed to the inefficiency of the teachers, who 'cannot give more than they possess,' and who are said by the inspector in Neuchatel to be lacking in method and professional skill.

From this cursory review of the instruction given in Swiss schools, it is clear that the range of subjects is not wider, nor the standard of attainment higher, than in the average of our own schools. Indeed, the impression left upon me by a careful study of the reports is that in the quality and extent of instruction given, the English schools are decidedly superior to the average schools in Switzerland.

The subject of religious instruction finds especial mention in several reports. This is a matter which is left entirely in the hands of the cantonal authorities, although the Federal Constitution provides that the rights of conscience shall be everywhere respected. Accordingly, in some of the cantons the instruction is decidedly religious and denominational. In others, again, it is merely ethical; and in a few districts, though not in any canton, as a whole, so far as I am aware, it is neglected altogether. In the Protestant cantons, however, specific doctrinal teaching is passing out of the hands of the teachers, and is being committed to the clergy, while the school instruction is now limited to those parts of the subject which have an immediate bearing on conduct, particularly in the family and the school. But the Swiss still adhere to a religious system, and the attempt to appoint a federal under-secretary, in December last, was decisively rejected by the popular vote, mainly because it threatened to limit cantonal freedom in this matter, and to bring about a purely secular system of education.

(*b*) *Supplementary Schools.*—Some idea of the results of the primary instruction in Switzerland may be gathered from the attainments of the pupils attending the supplementary schools; and as these form an interesting feature of the system, a short reference to them will not be deemed inappropriate. These schools are intended to bridge over the period between the completion of the legal school age and the entrance upon the duties of citizenship. They are a combination of mechanics' institutes and night-schools; but all the youths attending them, having passed through the primary schools, they stand in closer alliance with the national system, of which, indeed, they may be regarded as the complement and crown. They do not seem, however, to be fully and completely organised; and since they are diminishing in number in some districts, it does not seem clear whether they will receive a more complete development or whether they will eventually die out. On the one hand, there seems to be a very general conviction that it is the duty of the State to provide for the education of the youth of the country between the ages of fifteen and twenty, so that they may not enter upon the duties of citizenship without a revision and completion of the subjects learned in school. On the other hand, it has not yet been decided what form the provision shall take, what subjects it shall include, at what time it could best be given, how the expenses shall be met, and finally, whether attendance shall be voluntary or compulsory. Clearly the problem has not yet been solved; and while no good results are anticipated from a permissive system, nearly every canton hesitates to resort to compulsion, since such a system applied to youths of sixteen years of age would be almost certain to defeat its own ends. Meantime, two cantons have boldly decided on a compulsory system, for the young men at least, which is said to work well.

The total number of supplementary schools is 818, and the number of scholars attending them is 14,202, which is nearly one-thirtieth of the number attending the day-schools. Each school receives a State contribution, averaging about £3 per school. The course of instruction is generally a revision of the school subjects. Indeed, it is universally admitted that the instruction, to be useful, must be elementary in its character, and limited to three, or at most, four subjects. A few of the schools are technical and industrial in their character; and in some drawing, book-keeping, and elementary science are taught. Where the attendance is voluntary—that is, in twenty-three cantons—'the pupils which most need instruction never attend.' But with a select class of pupils it is still found that they are ill-prepared—that they have very little zeal for the work, that they are especially deficient in composition, and that they have forgotten most of the geography and history they had learned in the primary school. The effect of these unsatisfactory results is to deepen the desire for a general compulsory system, and probably this will be the issue to which the discussion of them will lead. But it is difficult to force youths over fifteen years of age into school; and a further difficulty lies in the lack both of time and teaching power. At present, the schools most frequently meet in the evening or Sunday morning, and the time devoted to them is from two to five hours a week, and their general condition confirms the conclusion I have already drawn as to the character of the instruction given in the Elementary Schools.

(To be continued.)

Query Column.

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents, who send questions for solution, would give (if possible) the required answer, and the source from which the question is obtained.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. **When a pseudonym is adopted it should be written at the end of the query, and the real name and address on a separate piece of paper.**

4. Correspondents are requested to write their queries *legibly*, and on one side of the paper only.

5. Replies will not be sent through the post.

6. Queries must reach the office *not later than the 12th of the month*, or they cannot be attended to in the following issue.

*** All communications for this column should be addressed—'*The Query Editor*,' *The Practical Teacher*, *Pilgrim Street, Ludgate Hill, London, E.C.*

Arithmetic.

1. JOAN AP DAFYDD.—In a 100 yards race, A can beat B by 10 yards; B in the same distance can beat C by 10 yards; by how many yards can A beat C? (*Ricks.*)

A runs 100 yards while B runs 90 yards,
B „ 100 „ „ C „ 90 „
∴ A „ 100 „ „ C „ $\frac{90}{100}$ of 90 yards
$= 81$ yards;
∴ A can beat C by $(100 - 81)$ yards $= 19$ yards. Ans.

2. REGULUS.—I bought note-paper at the rate of 3s. 7½d. for 5 quires, and sold it so as to gain as much on the *cost* of 32 quires as 3 quires were *sold* for. At what rate did I sell the paper per quire? (*P. T.'s Examination, September*, 1880.)

Selling price of 32 quires = cost price of 32
+ selling price of 3 quires,
Selling price of $(32 - 3)$ quires = cost price of 32 quires,
Selling price of 29 quires = cost price of 32 quires,
∴ Selling price per quire = $\frac{29}{32}$ of cost price per quire

$$= \tfrac{29}{32} \text{ of } \frac{3\text{s. } 7\tfrac{1}{2}\text{d.}}{5}$$

$$= \left(\frac{\cancel{29}}{\cancel{32}_{16}} \text{ of } \frac{\cancel{87}^{3}}{\cancel{10}_{5}}\right)\text{d.}$$

$$= 9\tfrac{3}{4}\text{d.} \quad \text{Ans.}$$

3. ROGO.—Find a number of six digits with 7 in the units' place, such that when the left-hand figure is removed to the right-hand, the number thus formed is equal to three times the original number.

Let the original number be represented thus:—*abcde* 7;
Then the number formed by transposing the left-hand figure to the right-hand would be:—*bcde* 7 *a*.
The number *bcde* 7 *a* is three times the number *abcde* 7, and from this statement we can easily obtain the value of the letters *a*, *b*, *c*, *d*, and *e*.

3 times 7 = 21, and therefore $a = 1$.

Now, 3 times $e + 2$ must give a number ending with 7,
that is, 3 times e „ „ „ „ „ „ 5;
∴ e must be 5. 3 times 5 = 15.

Now, 3 times $d + 1$ must give a number ending with e or 5,
that is, 3 times d „ „ „ „ „ „ 4;
∴ d must be 8. 3 times 8 = 24.

Now, 3 times $c + 2$ must give a number ending with d or 8,
that is, 3 times c „ „ „ „ „ „ 6;
∴ c must be 2. 3 times 2 = 6.

Now, 3 times b must give a number ending with c or 2;
∴ b must be 4.

∴ The original number *abcde* 7 = 142857. Ans.

4. Y.—Find to 6 places of decimals the sum of the series:—

$$\tfrac{3}{5} + \frac{4}{5\cdot10} + \frac{8}{5\cdot10\cdot15} + \frac{16}{5\cdot10\cdot15\cdot20}, \text{ etc.}$$

$\frac{3}{5} = \cdot4$

$\frac{4}{5\cdot10} = \frac{2}{10}$ of $\cdot4 = \cdot08$

$\frac{8}{5\cdot10\cdot15} = \frac{2}{15}$ of $\cdot08 = \cdot01066666$

$\frac{16}{5\cdot10\cdot15\cdot20} = \frac{2}{10}$ of $\cdot0106 = \cdot00106666$

$\frac{32}{5\cdot10\cdot15\cdot20\cdot25} = \frac{2}{25}$ of $\cdot00106 = \cdot00008533$

$\frac{64}{5\cdot10\cdot15\cdot20\cdot25\cdot30} = \frac{2}{30}$ of $\cdot0000853 = \cdot00000568$

$\frac{128}{5\cdot10\cdot15\cdot20\cdot25\cdot30\cdot35} = \frac{2}{35}$ of $\cdot00000568 = \cdot00000032$

$\cdot49182465$

$= \cdot491824$. Ans.

5. PHONO.—A, B, and C row from Cambridge to Ely, and the rate of current is ·6 of the difference between A's and C's rates of rowing; suppose C's rate per hour to be ·90 of B's, ·083 of A's to be ·0384615 of 13 miles, and ·0625 of B's to be ·0572916 of A's, and suppose also that B left Cambridge ·6 of an hour after A, and C ·6 of an hour after B, find how far B and C were asunder, when A was 7 miles from Ely, ·00625 of the distance between Cambridge and Ely being ·125 of a mile.

·083 of A's rate per hour = ·0384615 of 13 miles,
$\frac{1}{13}$ „ „ $= \frac{1}{10}$ of 13 miles
$= \frac{1}{2}$ mile;
∴ A's rate per hour $= (\frac{1}{2} \times 12)$ miles
$= 6$ miles.

·0625 of B's rate per hour = ·0572916 of A's rate,
$\frac{1}{16}$ „ „ $= \frac{11}{192}$ of A's rate
$= \frac{11}{192}$ of 6 miles
$= \frac{11}{32}$ mile;
∴ B's rate per hour $= (\frac{11}{32} \times 16)$ miles
$= 5\frac{1}{2}$ miles.

C's rate per hour = ·90 of B's rate,
$= \frac{10}{11}$ of $5\frac{1}{2}$ miles
$= 5$ miles.

Rate of current per hour = ·6 of $(6 - 5)$ miles
$= \frac{3}{5}$ mile.

Distance between Cambridge and Ely $= (\cdot125 \div \cdot00625)$ miles
$= (\frac{1}{8} \div \frac{1}{160})$ miles
$= 20$ miles.

Distance gone by A $= (20 - 7)$ miles
$= 13$ miles;
∴ Time it takes A $= \frac{13}{6\frac{3}{5}}$ hours
$= \frac{13}{\frac{33}{5}}$ hours;
Distance gone by B $= \{(\frac{13}{16} - \cdot6) \times (5\frac{1}{2} + \frac{3}{5})\}$ miles
$= \{(\frac{13}{16} - \frac{3}{5}) \times (\frac{11}{2} + \frac{3}{5})\}$ miles
$= \left\{\frac{117 - 40}{60} \times \frac{33 + 4}{6}\right\}$ miles
$= \{\frac{77}{60} \times \frac{37}{6}\}$ miles
$= \frac{2849}{360}$ miles;
Distance gone by C $= \{(\frac{17}{16} - \cdot6) \times 5\frac{1}{2}\}$ miles
$= \{(\frac{17}{16} - \frac{3}{5}) \times \frac{11}{2}\}$ miles
$= \left\{\frac{77 - 36}{60} \times \frac{11}{2}\right\}$ miles
$= \{\frac{41}{60} \times \frac{11}{2}\}$ miles
$= \frac{451}{120}$ miles;

∴ Distance between B and C = $(\frac{2849}{360} - \frac{697}{360})$ miles
$= \frac{2849 - 1394}{360}$ miles
$= \frac{1455}{360}$ miles
$= \frac{97}{24}$ miles
$= 4\frac{1}{24}$ miles
$= 4$ miles $73\frac{1}{2}$ yards. Ans.

6. PUZZLED.—What sum must be invested in the 4 per cent. consols at $90\frac{3}{8}$ (with usual brokerage) to secure an annuity of £150, free of income tax, which is 5d. in the £?

s. d.	£	£	
19 7	: 19 5	:: 1	: Annuity with income tax
12	30	240	
239		240	
47			

$= £\frac{7200}{47}$.

£	£	£	
∴ 4	: $\frac{7200}{47}$	:: $90\frac{3}{8}$	: Sum invested
		900	

$= \frac{7200}{47} \times 181$ £
$= \frac{1302900}{47}$ £
$= £3,465$ 19s. $1\frac{17}{47}$d. Ans.

7. DON.—How many gallons of spirits at 31s. per gallon must be added to 16 gallons at 17s. per gallon, and 19 gallons at 27s. per gallon, to make the mixture worth 26s. per gallon?

Gain on spirits at 17s. = (26s. − 17s.) × 16
= 9s. × 16
= 144s.;
Loss ,, ,, ,, 27s. = (27s. − 26s.) × 19
= 19s.
∴ ,, ,, ,, ,, 31s. = 144s. − 19s.
= 125s.
,, ,, a gallon at 31s. = 31s. − 26s.
= 5s.
∴ Quantity at 31s. = (125 ÷ 5) gals.
= 25 gals. Ans.

8. TEACHER.—A sum is laid out in the 3 per cents. at $89\frac{3}{8}$, and a half-year's dividend received upon it; the stock being then sold at $94\frac{1}{8}$, and the whole increase of capital being £54, find the original sum laid out. (*Colenso.*)

Increase on an investment of $£89\frac{3}{8}$ = $(£94\frac{1}{8} - £89\frac{3}{8}) + \frac{1}{2}$ of £3
= $£5\frac{1}{4} + £1\frac{1}{2}$
= $£6\frac{3}{4}$.

£	£	£	
∴ $6\frac{3}{4}$	: 54	:: $89\frac{3}{8}$	: sum invested
8		8	
54		715	

= £715. Ans.

9. SUBSCRIBER.—The price of land about London is every year rising 4 per cent. on previous years, while the purchasing power of gold as regards general commodities is falling $\frac{1}{2}$ per cent. per annum. A proprietor sells half his land this year for £8000, and invests the proceeds at 5 per cent. He proposes to sell the remainder 3 years hence, and to invest the money in the same way. What income would now represent the purchasing power of the income he will have obtained when the sales are completed?

Value of the land 1 year hence = £8000 × $\frac{104}{100}$
= £8320;
,, ,, ,, 2 years ,, = £8320 × $\frac{104}{100}$
= £8652·8;
,, ,, ,, 3 ,, ,, = £8652·8 × $\frac{104}{100}$
= £8998·912.
Purchasing power of £100 1 year hence = £100 × $\frac{199}{200}$
= £99·5;
,, ,, ,, 2 years ,, = £99·5 × $\frac{199}{200}$
= £99·0025;
,, ,, ,, 3 ,, ,, = £99·0025 × $\frac{199}{200}$
= £98·5074875.
Total income = 5 per cent. on £8000 + £8998·912
= ,, ,, ,, £16,998·912
= £849·9456;
∵ Purchasing power of total income = 98·5074875 × $\frac{849·9456}{100}$
= £837·2600556768
= £837 5s. 2·413362432d. Ans.

10. AUGUSTINE.—Show that the square root of 0·37 exceeds the cube root of 0·217 by a difference which very nearly equals $1\frac{1}{10}$. (*Science and Art Department*, 1883.)

·37 (·6082762
36 (
1208 | 10000
9664
12162 | 33600
24324
121647 | 927600
851529
1216546 | 7607100
7299276
12165522 | 30782400
24331044
6451356

∵ Square root of ·37 = ·6082762...

·217 (·6009
216 (
$600^2 \times 300$ = 108000000 | 1000000000
$600 \times 9 \times 30$ = 162000
9^2 = 81
108162081 | 973458729
26541271

$·6009^2 \times 3 = ·36108081 \times 3 = 1·08324243$;

1·08324243) ·0000265412710 (·0000245
216648486 (
487642240
433296972
543452680
541621215
1831465

∴ Cube root of ·217 = ·6009245...
$\sqrt{·37} - \sqrt[3]{·217}$ = ·6082762... − ·6009245
= ·0073517...
$1\frac{1}{10}$ = ·0073529... Ans.

11. SIGMA.—A person invests a sum of money in the $3\frac{1}{2}$ per cent. consols at $86\frac{1}{4}$; after receiving a half-year's dividend he sells out at $92\frac{1}{4}$, and finds his whole increase of capital to be £122. Find the sum invested.

Increase on an investment of $£86\frac{1}{4}$ = $(£92\frac{1}{4} - £86\frac{1}{4}) + \frac{1}{2}$ of £3½
= $£5\frac{1}{2} + £1\frac{3}{4}$
= $£7\frac{1}{4}$.

£	£	£	
∴ $7\frac{1}{4}$	: 122	:: $86\frac{1}{4}$	: sum invested
8	2	8	
58		690	

= £1380. Ans.

12. TEACHER.—A man spends every year $\frac{3}{4}$ of his income, and invests the rest in annuities at the rate of £90 for every annuity of £3. His income is £600 to begin with; how much will it be at the end of 4 years? (*Scholarship*, 1870.)

Income at the end of 2nd year = £600 + $\frac{1}{10}$ of £200
= £600 + £60
= £660;
,, ,, ,, 3rd ,, = £660 + $\frac{1}{10}$ of $\frac{1}{4}$ of £660
= $\frac{11}{40}$ of £660
= $\frac{91 \times 128}{9 \times 3}$ £
= $£\frac{1456}{27}$;
,, ,, ,, 4th ,, = $£\frac{91}{135}$ of $£\frac{1456}{27}$
8281
= $\frac{91 \times 1456}{945 \times 27}$ £
45
= $£\frac{132496}{1215}$
= £620 4s. $5\frac{1}{3}$d. Ans.

Mensuration.

1. J. EDWARDS (Burton-on-Trent).—Water is rising in a cellar, whose level floor has an area of 2000 sq. ft., at the rate of 6 in. per hour, and is $1\frac{1}{2}$ ft. deep when a pump, which discharges at the rate of 1800 cub. ft. per hour, is set to work. If the pump is alternately worked for 10 min. and stopped for 3 min., how soon will the cellar be dry? (*Excise*, May, 1881.)

Quantity of water in cellar $= (2000 \times 1\frac{1}{2})$ cub. ft.
$= 3000$ cub. ft.;

Quantity filled in 13 min. $= \left(\frac{\cancel{2}\cancel{0}\cancel{0}\cancel{0}}{\cancel{3}} \times \frac{1}{\cancel{2}} \times \frac{13}{\cancel{6}\cancel{0}}\right)$
$= 108\frac{1}{3}$ cub. ft.;

,, discharged ,, $= \left(1800 \times \frac{10}{60}\right)$ cub. ft.
$= 300$ cub. ft.;

∴ Decrease in 13 min. $= (300 - 108\frac{1}{3})$ cub. ft.
$= \frac{900 - 650}{3}$ cub. ft.
$= 83\frac{1}{3}$ cub. ft.;

3000 cub. ft. $\div 83\frac{1}{3}$ cub. ft.
$= \frac{300 \times 3}{250}$
$= 36.$

Time to clear last $83\frac{1}{3}$ cub. ft.
$= [83\frac{1}{3} \div \{1800 - (2000 \times \frac{1}{4})\}]$ of an hour
$= \frac{250}{3 \times 800}$ hr.
$= \frac{\cancel{2}\cancel{5}0}{\cancel{3} \times \cancel{8}\cancel{0}\cancel{0}}$ min.
$= 5\frac{1}{4}$ min.;

∴ Time to clear the cellar $= \{(35 \times 13) + 6\frac{1}{4}\}$ min.
$= \{455 + 6\frac{1}{4}\}$ min.
$= 461\frac{1}{4}$ min.
$= 7$ hrs. 41 min. 15 sec. Ans.

2. SHANACHUS.—The sides AB and BC of an oblique parallelogram are 28 and 18; if the perpendicular from A on BC be 10, what must be the perpendicular from C on AB? (*Hunter's* 'Mensuration.')

Area of parallelogram $= 18 \times 10$
$= 180;$

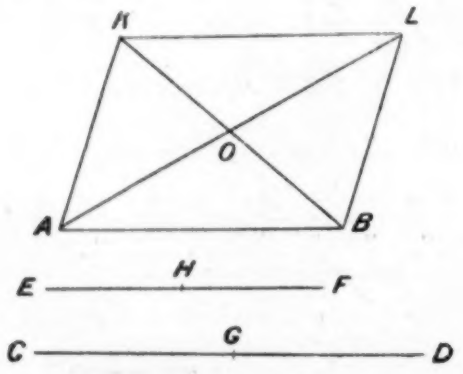
∴ Perpendicular from C on AB $= 180 \div 28$
$= \frac{45}{7}$
$= 6\frac{3}{7}.$ Ans.

Note.—Your writing is *very good*, and we think it would obtain the full percentage of marks at a Civil Service examination.

Geometry.

1. HELPLESS.—Construct the parallelogram whose diagonals and one side are equal to three given straight lines.

What condition must be fulfilled by the given lines, that it may be possible to construct the parallelogram? (*Science Examination*, 1882.)

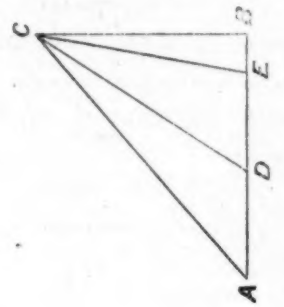


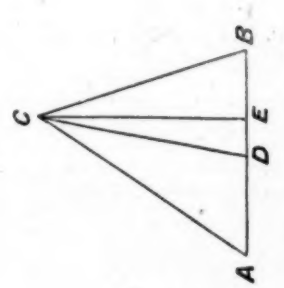
Let AB be the given side, and CD, EF the given diagonals.
Bisect CD and EF in G and H. (I. 10.)
Construct the triangle AOB, having its sides AO equal to CG and BO to EH. (I. 22.)
Produce AO to L, making OL equal to AO (I. 3.), and BO to K, making OK equal to BO.
Join AK, KL, and LB.
Then AK, LB shall be the parallelogram required.

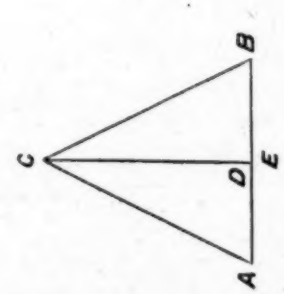
Proof.—In the triangles AOB, LOK, the two sides AO, OB = the two sides LO, OK, each to each (Con.),
and ∠ AOB = ∠ LOK, (I. 15.)
∴ base AB = base LK, (I. 4.)
and ∠ OAB = ∠ OLK.
Because alternate angles LAB, ALK are equal,
∴ AB, LK are parallel; (I. 27.)
wherefore AB, KL are both equal and parallel;
∴ AK, BL are both equal and parallel. (I. 33.)
Wherefore AKLB is the parallelogram required.—Q. E. F.

The triangle AOB cannot be constructed, if any two sides are greater than the third side—that is, the sum of half the diagonals greater than the given side, or the given side and half of one of the diagonals greater than half of the other diagonal.

2. ANXIOUS.—In any triangle the sum of the squares on the sides is equal to twice the square on half the base together, with twice the square on the straight line drawn from the vertex to the middle point of the base. (*Todhunter.*)







Let ABC be a triangle, and let D be the middle point of the base AB.
Draw CE perpendicular to AB; then E may be either in AB or in AB produced.

Proof.—If E coincide with D, then the proposition follows immediately from I. 47.

If not, then one of the angles ADC, BDC must be obtuse; suppose the angle ADC obtuse.

Then, Sq. on AC = squares on AD, DC + twice rect. ADDE; (II. 12.)

Sq. on BC = squares on BD, DC − twice rect. BD, DE; (II. 13.)

But AD = BD; (Hyp.)

∴ Squares on AC, BC = Twice squares on AD, DC. (Ax. 2.)

Q. E. D.

Note.—*Angus's* 'Handbook of the English Tongue' (*Religious Tract Society*), 4s. 6d.; *Dickinson's* 'History of English Language' (*Hughes*), 3d.; etc.

Algebra.

1. INQUISITIVE.—Simplify:—

$$\frac{\sqrt{a^2+\left\{\frac{a(1-m)}{2\sqrt{m}}\right\}^2}+a\frac{m-1}{2\sqrt{m}}}{\sqrt{a^2+\left\{\frac{a(1-m)}{2\sqrt{m}}\right\}^2}-a\frac{m-1}{2\sqrt{m}}}.$$

(*Edinburgh University M.A. Examination.*)

$$\frac{\sqrt{a^2+\left\{\frac{a(1-m)}{2\sqrt{m}}\right\}^2}+a\frac{m-1}{2\sqrt{m}}}{\sqrt{a^2+\left\{\frac{a(1-m)}{2\sqrt{m}}\right\}^2}-a\frac{m-1}{2\sqrt{m}}}$$

$$=\frac{\sqrt{\frac{4a^2m+a^2(1-2m+m^2)}{4m}}+\frac{a(m-1)}{2\sqrt{m}}}{\sqrt{\frac{4a^2m+a^2(1-2m+m^2)}{4m}}-\frac{a(m-1)}{2\sqrt{m}}}$$

$$=\frac{\sqrt{\frac{a^2(1+2m+m^2)}{4m}}+\frac{a(m-1)}{2\sqrt{m}}}{\sqrt{\frac{a^2(1+2m+m^2)}{4m}}-\frac{a(m-1)}{2\sqrt{m}}}$$

$$=\frac{\frac{a(1+m)}{2\sqrt{m}}+\frac{a(m-1)}{2\sqrt{m}}}{\frac{a(1+m)}{2\sqrt{m}}-\frac{a(m-1)}{2\sqrt{m}}}$$

$$=\frac{\frac{2am}{2\sqrt{m}}}{\frac{2a}{2\sqrt{m}}}$$

$=m.$ Ans.

Note.—Each correspondent is restricted to *one* question.

2. P. T.—A and B run a mile. At the first heat A gives B a start of 20 yards, and beats him by 30 seconds. At the second heat A gives B a start of 32 seconds, and beats him by $9\frac{8}{11}$ yds. Find the rate per hour at which A runs. (*Todhunter's* 'Algebra for Beginners.')

B runs $(20-9\frac{8}{11})$ yards in $(32-30)$ seconds

$=10\frac{8}{11}$ yards in 2 seconds

$=5\frac{4}{11}$ yards in a second.

Let x = A's rate per second in yards,

Then, $\frac{1760-20}{5\frac{4}{11}}-\frac{1760}{x}=30$

$$\frac{174}{5\frac{4}{11}}-\frac{176}{x}=3$$

$$33-\frac{176}{x}=3$$

$$33-3=\frac{176}{x}$$

$$30=\frac{176}{x}$$

$$30x=176$$

$$\therefore x=\tfrac{88}{15}.$$

$$\therefore \text{A's rate per hour}=\left(\frac{\overset{4}{\cancel{88}}\times\overset{3}{\cancel{60}}\times\overset{}{\cancel{60}}}{\underset{}{\cancel{15}}\times\underset{}{\cancel{17}}\underset{}{\cancel{60}}}\right)\text{miles}$$

$$=\underline{12 \text{ miles}}. \quad \text{Ans.}$$

3. CRUACHAN.—Find the condition that ax^3+bx^2+c, and $a'x^3+b'x^2+c'$ may have a common factor. (*London University Intermediate Arts*, 1882.)

$$ax^3+bx^2+c\Big)a'x^3+b'x^2+c'\quad\left(\frac{a'}{a}\right.$$

$$\underline{a'x^3+\frac{a'b}{a}x^2+\frac{a'c}{a}}$$

$$\frac{ab'-a'b}{a}x^2+\frac{ac'-a'c}{a}$$

$$\frac{ab'-a'b}{a}x^2+\frac{ac'-a'c}{a}\Big)ax^3+bx^2+c\quad\left(\frac{a^2}{ab'-a'b}x+\frac{ab}{ab'-a'b}\right.$$

$$\underline{ax^3+\frac{a(ac'-a'c)}{ab'-a'b}x}$$

$$bx^2-\frac{a(ac'-a'c)}{ab'-a'b}x+c$$

$$\underline{bx^2+\frac{b(a'c-ac')}{ab'-a'b}}$$

$$-\frac{a(ac'-a'c)}{ab'-a'b}x+c-\frac{b(a'c-ac')}{ab'-a'b}$$

$$\frac{a(ac'-a'c)}{ab'-a'b}x-\frac{c(ab'-a'b)+b(a'c-ac')}{ab'-a'b}$$

$$\left(\frac{a(ac'-a'c)}{ab'-a'b}x+\frac{a(bc'-b'c)}{ab'-a'b}\right)\left(\frac{ab'-a'b}{a}x^2+\frac{ac'-a'c}{a}\right)$$

$$\frac{a(ac'-a'c)}{ab'-a'b}x^3+\frac{(ab'-a'b)(bc'-b'c)}{a(ac'-a'c)}x^2+\frac{ac'-a'c}{a}$$

$$-\frac{(ab'-a'b)(bc'-b'c)}{a(ac'-a'c)}x^2-\frac{(ab'-a'b)(bc'-b'c)}{a(ac'-a'c)}x-\frac{(ac'-a'c)^2}{a(ac'-a'c)^2}$$

$$\frac{(ab'-a'b)^2}{a^2(ac'-a'c)}x-\frac{(ab'-a'b)^2(bc'-b'c)}{a^2(ac'-a'c)^2}$$

$$\therefore \frac{ac'-a'c}{a} \text{ must equal } -\frac{(ab'-a'b)(bc'-b'c)^2}{a(ac'-a'c)^2}$$

$$(ac'-a'c)^3 \text{ must equal } -(ab'-a'b)(bc'-b'c)^2.$$

Note.—'Algebraic Factors Simplified' (Stewart and Co.), 1s. 6d.

4. SOLICITOR.—A person sculling in a thick fog meets one barge and overtakes another, which is going at the same rate as the former; show that if (a) be the greatest distance to which he can see, and b, b' the distances that he sculls between the times of his first seeing and passing the barges,

$$\frac{2}{a}=\frac{1}{b}+\frac{1}{b'}. \quad (\textit{Hamblin Smith.})$$

Let x = rate of sculler,

And ,, y = ,, barges;

$$\text{Then, (1) } \frac{b}{x}=\frac{a-b}{y}\qquad \text{(2) } \frac{b'}{x}=\frac{b'-a}{y}$$

$$\text{(1) } \frac{b}{a-b}=\frac{x}{y}\qquad \text{(2) } \frac{b'}{b'-a}=\frac{x}{y}$$

$$\therefore \frac{b}{a-b}=\frac{b'}{b'-a} \quad \text{(Ax. 1.)}$$

$$bb'-ab=ab'-bb'$$
$$2bb'=ab'+ab$$
$$=a(b'+b)$$
$$\frac{2}{a}=\frac{b'+b}{bb'}$$
$$\therefore \frac{2}{a}=\frac{1}{b}+\frac{1}{b'}.$$

5. IMPRIMATUR.—A labourer can save out of his weekly wages 10 per cent.; his wages rise 1s. per week, but his expenses increasing also 10 per cent., he can now only save 5 per cent. of his increased wages. Find his weekly wages. (*Scholarship*, 1876.)

Let $100x$ = his weekly wages in shillings,
Then $90x$ = " " expenses " ;
And $90x \times \frac{11}{10}$ or $99x$ = his increased weekly expenses in s.;
Also $100x+1$ = his weekly wages after increase in s.;

$$\therefore 100x+1-99x=\frac{100x+1}{20}$$
$$x+1=\frac{100x+1}{20}$$
$$20x+20=100x+1$$
$$20x-100x=1-20$$
$$-80x=-19$$
$$\therefore x=\tfrac{19}{80}.$$

$\therefore$ His weekly wages $=(\frac{19}{80}\times 100)$s.
$=\frac{95}{4}$s.
$=£1\ 3s.\ 9d.$ Ans.

6. LEICESTERSHIRE.—Whilst taking a walk in the country I counted a flock of sheep passing through a gate; on resuming my walk I calculated that the product of $\frac{1}{20}$, $\frac{1}{30}$, $\frac{1}{40}$, and $\frac{1}{50}$ of the number was 6750. How many were there?

Let x = No. of sheep,

$$\text{Then, } \frac{x}{20}\times\frac{x}{30}\times\frac{x}{40}\times\frac{x}{50}=6750$$
$$\frac{x^4}{1,200,000}=6750$$
$$x^4=8,100,000,000$$
$$x^2=90,000$$
$$x=300.$$

$\therefore$ No. of sheep $=300$. Ans.

7. CORRESPONDENT.—A number of persons were engaged to do a piece of work, which would have occupied them m hours if they had commenced at the same time; but instead of doing so, they commenced at equal intervals, and then continued to work till the whole was finished; the payment being proportional to the work done by each; the first comer received r times as much as the last. Find the time occupied. (*Todhunter.*)

Let x = No. of hours of work of last person,
Then $2x$ = " " " " " but one, etc., etc.
And rx = " " " first " ;
$\therefore$ Total " " " $=\frac{xr(r+1)}{2}$;

But this is equal to mr;

$$\therefore \frac{xr(r+1)}{2}=mr$$
$$\frac{x(r+1)}{2}=m$$
$$\therefore x=\frac{2m}{r+1}.$$

$\therefore$ Time occupied $(rx)=\frac{2mr}{r+1}$ hours.

8. SYNOPSIS.—Sum the series:

$$1+2^2x+3^2x^2+\ldots\ldots+(n+1)^2x^n.$$

(*Intermediate Examination in Arts*, 1881.)

Let $S=1+2^2x+3^2x^2+\ldots\ldots+(n+1)^2x^n$,
Multiplying by x and subtracting,
Then $S(1-x)=1+3x+5x^2+\ldots\ldots+(2n+1)x^n$
$-(n+1)^2x^{n+1}$;
Again, let $s=1+3x+5x^2+\ldots\ldots+(2n+1)x^n$,
Multiplying x and subtracting,

$$\text{Then, } s(1-x)=1+2x+2x^2+\ldots\ldots+2x^n-(2n+1)x^{n+1}$$
$$=1+\frac{2x(1-x^n)}{1-x}-(2n+1)x^{n+1}$$
$$\therefore s=\frac{1-(2n+1)x^{n+1}}{1-x}+\frac{2x(1-x^n)}{(1-x)^2};$$
$$\therefore S=\frac{1-(2n+1)x^{n+1}}{(1-x)^2}+\frac{2x(1-x^n)}{(1-x)^3}-\frac{(n+1)^2x^{n+1}}{1-x}.$$ Ans.

General.

1. SIGMA.—Number of vibrations of a string vary as the square root of the stretching force, inversely as the length of the string, inversely as the area of a section of the string. Or, $n \propto \frac{\sqrt{w}}{la}$ where n is number of vibrations, w the stretching force, l the length, a the area. If the volume of the cord remains constant, l increases as a decreases, and the two quantities may be eliminated. This leaves $n \propto \sqrt{w}$, or in the case in question,

$$\frac{n_2}{n_1}=\frac{\sqrt{f_2}}{\sqrt{f_1}} \therefore n_2=\frac{n_1\sqrt{f_2}}{\sqrt{f_1}}$$

2. P. Z.—Your query is solved in our issue for January, 1882.

3. WALTER LE MASURIER will send twelve stamps for No. 11, vol. i., of the PRACTICAL TEACHER. Apply St. Philip's School, New Street, Stepney, E.

4. J. WEBB.—Apply to the Diocesan Inspector, or to the Secretary National Society's Depository, S.W.

5. GANYMEDE.—'German for the English' is published by *D. Nutt*, Strand, W.C., at 4s. 6d.

6. ASSISTANT's interpretation may be right; we hope it is. But we have heard of the immediate application of Art. 62, where 'six months' is the first least period of probation, instead of 'three months,' as formerly. We hope soon to make an authentic announcement both with regard to this Article and Article 68 also.

7. A. A. T. must consult the Code, Art. 55 to 60. For a teacher not to acquaint himself with the requirements of the Code, 1883 (just published, price 4d.), is 'great unwisdom.' Your books are good. Get up your geography from maps.

8. BON FRERE would do well to study *Mansford's* or *Fitch's* 'Arithmetic.'

9. CONFIDENCE cannot take 'blackboard' in November unless he has passed in the other four drawing subjects (Code, Schedule V., Drawing.)

10. DEVON.—'There was,' etc., *prin. sent.*; 'what this,' etc., *n. sent., obj. to* '*guessing*'; 'and the king thought,' *prin. sent. co-ord.*; 'whose father,' etc., *adj. sent., qual.* '*king*'; 'that this,' etc., *noun sent., obj. to* '*thought*'; 'what,' *comp. rel. adv. to* '*evil*'; 'blown,' *part. adj., qual.* '*house.*'

11. ITHON.—Yes; but unless the child is over age, it is a doubtful advantage to present him in a higher standard. The division between the weeks must be determined by yourself. The intention, we presume, was that Monday should begin the week. All children whose names have been on the registers twenty-two weeks must be presented (Code, Art. 107).

12. RECUERDO gives us a heavy task—'look at the Syllabus,' and select a library for him with a view to 'working up for the certificate examination.' The books he names are good; his friends will counsel him with regard to others. By asking an acquaintance now at some training-college, he might learn what 'selection' has there been made with reference to any particular subject of study.

13. REGNAR.—*Langley's* concise manual on 'Popular Astronomy and Mathematical Geography' (6d.) contains what is needful for P.-T.'s. Every work on physiography or physical geography has chapters on currents, tides, etc., and some also explain the planetary system.

14. BON SOIR will see that the Syllabus prescribes 'Julius Cæsar' and 'Bacon's Essays' (38-58). Both will be required.

15. MISTRESS will find that the New Code supersedes the Old Code in all particulars. She is right in preparing her P.-T. accordingly.

16.
As—adv. of degree, qual. 'little.'
little—adj. of quality, qual. 'prince.'
prince—com. noun, mas., sing., nom. after 'am,' understood.
having—pres. part. of 'to have,' referring to 'I,' understood.
so—adv. of degree, qual. 'great.'
great—adj. of quality, qual. 'title.'
a—adj. of distinction, limiting 'title.'
title—abs. noun, neut., sing., obj., gov. by 'having.'
to be—verb, irreg. intrans., infin., pres., gov. by 'title.'
more—adj. of quality, qual. 'prince.'
as—copulative conj., joining the sentences '*I am* as little prince' and '*I* may be.'
may—irreg. intrans. verb, auxiliary to 'be,' indicating potential mood, pres. tense.
be—irreg. intrans. verb, infin., pres., gov. by 'may.'
maybe—irreg. intrans. verb, act. voice, pot. mood, present tense, 1st pers., sing., agreeing with its nom. 'I,' understood.

The words are a reply to an address—'Good morrow, prince.' Arthur, who feels himself slighted, and without either the respect due to or the authority of a prince, answers—'*I am* as little *a* prince, having so great a title to be more *a* prince, as *I* (can) may be.'

17. PAX.—Sufficient data are not given for the solution of your query, as the relation between the heights of the boxes should be stated. The statement of 126 feet of wood is not required, and it therefore seems as if the question were given incorrectly.

18. WEG should obtain *Tanner's* 'Advanced Agriculture,' *Mrs. Fawcett's* 'Political Economy,' and *Michael Foster's* work on 'Physiology.'

19. P. T. K.—The information as to 'graduated' piano-music will be found in 'The Musician,' Grade I., by *Ridley Prentice*, published by W. Swan Sonnenschein.

—o—

Julius Cæsar.

ACT I.

Scene II. A Public Place.

Bru. What means this shouting? I do fear, the people
Choose Cæsar for their king.
Cas. Ay, do you fear it?
Then must I think you would not have it so.
Bru. I would not, Cassius; yet I love him well.
But wherefore do you hold me here so long?
What is it that you would impart to me?
If it be aught toward the general good,
Set honour in one eye and death i' the other,
And I will look on both indifferently,
For let the gods so speed me as I love
The name of honour more than I fear death.
Cas. I know that virtue to be in you, Brutus,
As well as I do know your outward favour.
Well, honour is the subject of my story.
I cannot tell what you and other men
Think of this life; but, for my single self,
I had as lief not be as live to be
In awe of such a thing as I myself.
I was born free as Cæsar; so were you:
We both have fed as well, and we can both
Endure the winter's cold as well as he:
For once, upon a raw and gusty day,
The troubled Tiber chafing with her shores,
Cæsar said to me, 'Darest thou, Cassius, now
Leap in with me into this angry flood,
And swim to yonder point?' Upon the word,
Accoutred as I was, I plungèd in
The torrent roar'd, and we did buffet it
With lusty sinews, throwing it aside
And stemming it with hearts of controversy;
But ere we could arrive the point proposed,
Cæsar cried, 'Help me, Cassius, or I sink!'
I, as Æneas, our great ancestor,
Did from the flames of Troy upon his shoulder
The old Anchises bear, so from the waves of Tiber
Did I the tired Cæsar: and this man
Is now become a god, and Cassius is
A wretched creature, and must bend his body,
If Cæsar carelessly but nod on him.
He had a fever when he was in Spain,
And when the fit was on him, I did mark
How he did shake: 'tis true, this god did shake.
His coward lips did from their colour fly,
And that same eye whose bend doth awe the world
Did lose his lustre: I did hear him groan:
Ay, and that tongue of his that bade the Romans
Mark him and write his speeches in their books,
Alas, it cried, 'Give me some drink, Titinius,'
As a sick girl. Ye gods! it doth amaze me
A man of such a feeble temper should
So get the start of the majestic world
And bear the palm alone. [*Shout. Flourish.*
Bru. Another general shout!
I do believe that these applauses are
For some new honours that are heap'd on Cæsar.
Cas. Why, man, he doth bestride the narrow world
Like a Colossus, and we petty men
Walk under his huge legs and péep about
To find ourselves dishonourable graves.
Men at some time are masters of their fates:
The fault, dear Brutus, is not in our stars,
But in ourselves, that we are underlings.
Brutus and Cæsar: what should be in that 'Cæsar'?
Why should that name be sounded more than yours?
Write them together, yours is as fair a name;
Sound them, it doth become the mouth as well;
Weigh them, it is as heavy; conjure with 'em,
Brutus will start a spirit as soon as Cæsar.
Now, in the names of all the gods at once,
Upon what meat doth this our Cæsar feed,
That he is grown so great? Age, thou art shamed!
Rome, thou hast lost the breed of noble bloods!
When went there by an age, since the great flood,
But it was famed with more than with one man?
When could they say till now, that talk'd of Rome,
That her wide walls encompass'd but one man?
Now is it Rome indeed and room enough,
When there is in it but one only man.
O, you and I have heard our fathers say,
There was a Brutus once that would have brook'd
The eternal devil to keep his state in Rome
As easily as a king.

NOTES ON SCENE II.—(*continued.*)

79. *Fear.*—Another of the conceptions only proper to himself of line 41. Under the stimulus of Cassius' talk, and now the people's shout, with all its uncertainties, these are coming into the open.

80. *Do you fear it?*—Very readily, our judge of men seizes upon the unconscious confession.

82. At last! In this line the whole of Brutus in this matter is epitomised: 'I love him well; but I love Rome more.'

84. With a stress on the 'is.'

85. *Toward.*—A dissyllable, accented on the second syllable. Brutus is a better judge of principles than Cassius.

87. *Indifferently.*—With equal eye: as Claudius, in 'Hamlet' (I., ii., 13), with equal scale weighs delight and dole. Brutus, being great, would not look indifferently, in the modern sense, on honour or on death.

90. *That virtue.*—Of honour.

91. *Favour.*—Countenance. 'To be a well-favour'd man is a gift of fortune,' says Dogberry in 'Much Ado about Nothing' (III., iii., 14).

92. Ingeniously adapting that which he would say to the thought uppermost in Brutus' mind.

93. With this vague, dreamy, meditative commencement, he at once catches the attention of the introspective man.

95. A pun.

96. Here is the keynote struck of the comparison between themselves and Cæsar that leads to the necessity for attack upon him for lording it over his compeers.

105. *Accourred.*—*Custos ecclesiæ* was the sacristan of the church, who had charge of vestments. Hence accoustrer, and later accoutrer, to invest the priest with his garments, and so in time to clothe in any garments.

107. *Buffet.*—More often used as a noun.

108. *Sinews.*—The old and modern blunder for 'muscles.'

109. *Hearts of controversy.*—A twofold meaning in this. They are contending, each with each, and also with the stream. You would judge that Shakespeare was a swimmer from this passage and others, were it not that you have learnt that to accredit him with certain powers or personal qualifications because he can describe the employment of them is to make him capable of everything and member of every calling. Another fine passage on swimming will be found in the Tempest (II. i., 114—121):

> 'I saw him beat the surges under him,
> And ride upon their backs: he trod the water,
> Whose enmity he flung aside, and breasted
> The surge most swoln that met him: his bold head
> 'Bove the contentious waves he kept, and oar'd
> Himself with his good arms in lusty stroke
> To the shore, that o'er his wave-worn basis bowed,
> As stooping to relieve him.'

110. *Arrive.*—Note the omission of the preposition. *Proposed.*—Again with a double significance. *Pro*=before, *pono*=I place. They have proposed or suggested the point, and the point lies before them.

112. *Æneas.*—Prince and Trojan; son of Anchises and Venus. After the burning of Troy, the Roman authors, to curry favour with the Roman emperors, fable that he wandered for seven years over land and sea, until at length he reached Italy. There, defeating Turnus, wedding Lavinia, daughter of King Latinus, reigning in his turn, he founded, as the poets taught, the Roman race. The 'our great ancestor' of this line is in keeping with this fancy.

113. *Troy.*—Capital of Troas. The central city of old romance. There Paris, thief of Helen, was besieged of Greeks, and with its burning ended the long Trojan war.

114. *Anchises.*—His father. Æneas bore him and the household gods; he led along his son Ascanius. But he carelessly, or carefully, left his earlier wife Creusa behind. *Tiber.*—The river of Rome: see line 46 of preceding scene. Æneas landed in Italy first at Tiber mouth. This line is a dramatic Alexandrian. It has thirteen syllables, the last a slurred one.

117. Dramatic iambic.

119. *Spain.*—At Corduba, they say; our modern Cordova. This was in the year B.C. 49. The second civil war between Cæsar and the Pompeian party was then raging. In forty days he broke in pieces the power of that party, defeating Pompey's lieutenants Petreius and Afranius, and receiving the final surrender of Varro at this very Corduba. This would be some seven years before the action of the play.

122. The lips are trembling, and by a fine image their trembling is followed by their flight from the colour.

123. *Bend.*—Glance.

124. *His.*—Its. The word 'its' has had a curious history. At first there was no distinction between the masculine and neuter in this connection. The neuter form 'his' lasted on into the 17th century at least. Then came the usual transition stage, and 'his' or 'its' was used for neuter things, the former only for masculine ones. Shakespeare is partially representative of this condition. 'Its' is rare in him. Finally, the clear distinction between the 'his' for the masculine and the 'its' for the neuter came into vogue. Milton and Dryden mark the period of the general adoption of this distinction. The Bible of 1611 has not one 'its.'

125, 127, 128. Dramatic iambic lines. Titinius is the Titinius of the play.

131. *Palm.*—The palm was the reward of the victor in the race.

133, 134. The non-wish is father to the thought.

135. Bestride. 'Be' is intensitive, as in bedew. *Find other words with this prefix used with this meaning.*

136. *Colossus.*—The brazen image at Rhodes, chief town of Rhodus, an isle in the Carpathian Sea. Its feet rested on the two moles that bounded the harbour mouth. Between its legs ships passed in full sail. Its height was 105 feet. Twelve years Chares was at work upon the image, from 300 B.C. to 288 B.C. *We petty men.*—There is a shrewd wisdom in the use of this 'we.'

137. *Peep.*—Just the weak, stealthy, shamefast word needed here.

139. 'There is a tide in the affairs of man, that, taken at the flood, leads on to fortune,' is a parallel passage (IV., iii., 218, 219).

140. *Stars.*—The old fancy of the effect on human lives of the stars is here implied. The very word 'influence' is from *influx* =I flow into. The starlight was thought to flow into and affect the existence of men and women. Hence so many of our words and phrases: disaster—ill-starred—born under a lucky star—the vulgar cry, 'Oh, my stars!' Hence horoscopes, astrology, and, from this last, astronomy. To-day, we are still under the influence, but in a more real, more beautiful way. The loveliness of stars, as of seas and flowers, still sinks into the life and moulds it for good.

141. *In ourselves.*—Common sense brushing away the fanciful fallacies of all who explain their want of success by a reference to the 'fates' and the injustice of the 'world.' We may be sure that when a man or woman bewails failure, and blames fortune or the universe generally, the fault is in the speaker. *Underlings.*—The addition of the diminutive suffix 'ling' to the word 'under' makes the inferiority of position very marked.

142. An able appeal to Brutus' ambition. With exceeding dexterity Cassius not only uses Brutus' love for Rome against Cæsar, but uses his own natural longing to be great, to be powerful. Why should not Brutus be as great as Cæsar? How is it that the one is Dictator, the other only plain Brutus? The line is best read by taking the 'be in' as one syllable.

144. The 'is' has to be taken as part and parcel of the preceding word.

146. *With 'em* as one syllable. *Conjure* is used in the sense of calling up the supernatural.

147. *Spirit,* monosyllabic: the line a dramatic iambic.

150. *Age.*—The appeal to their own time is well aimed at Brutus.

151. *Bloods.*—Compare this use of the word with the more modern 'young bloods' for men about town.

152. *Flood.*—Deucalion's not Noah's. The reference in the next line, the 'one man,' is more meaningful then, as Deucalion was the solitary man survivor after Jupiter had drowned the earth by a flood. Noah had his three sons as male companions. Deucalion and his wife Pyrrha, saved in an ark, re-peopled the earth by casting stones behind them.

156. A punning line.

158. *You and I.*—It is matter of common talk, this.

159. *A Brutus once.*—The first consul after that expulsion of the royal family of Tarquins, in which he was chief instrument. *Brooked*=borne: bruean=to use, to digest (compare German brauchen).

161. *A king.*—To this Cæsar is aspiring. Look above to lines 79, 80. Brutus has fears that they do 'choose Cæsar for their king.'

161. Incomplete line.

(*To be continued.*)

Publications Reviewed.

Practical Chemistry, with Notes and Questions on Theoretical Chemistry. By William Ripper. William Isbister, Limited.

Mr. Ripper is evidently an experienced practical teacher of chemistry, and there is certainly no reason why he should not put the results of his practical experience in printed form. His scholars will, at all events, be saved some trouble in note-taking. Whether any other teacher will be likely to take Mr. Ripper's little volume as his text-book is open to question. Every teacher has, or ought to have, his own method. But there can be no question that the book will be of use to private

students. Very wisely the author puts the practical work first. If the so-called practical and theoretical aspects of a science are to be dealt with separately, clearly, the right order is that which is followed by Mr. Ripper. Our own contention, however, is that the two branches of study should be worked together. As a practical experiment is made, its theoretical bearings and consequences should be considered. The directions for work are good, and could only have come from one who has been taught and has taught practically. But we take very strong exceptions to one principle enunciated in the introduction: 'Before experimenting, find out exactly what you are going to do'—that is excellent—'and what results you are to expect'—that is not so excellent. If a student is told beforehand what ought to happen, there is danger that he will see it happen, at all costs. The best training is to give instructions and to ask for results. The student should be encouraged to describe in his own words that which occurs. His mind should not be prejudiced and his judgment arrested by telling him what is to occur. After the experiment his description of the consequences may be modified, corrected, translated into scientific phraseology if necessary. But to our thinking, few things are more inimical to the cultivation of the powers of observation than telling young students beforehand what they are to observe. The qualifications for future research, when that which is to happen cannot be predicted with certainty, would not be fostered by such teaching as this.

There is some carelessness of grammatical expression here and there in the book, and, in more than one case, that which is far worse than grammatical inaccuracy, carelessness of scientific phrasing. Thus we have the direction to 'remove the heat,' and in the same paragraph the erroneous statement that in 'sucking back' the resulting fracture is due to the cold water and not to the steam generated. Formulæ are, at times, wanting in perfect accuracy. Many solitary atoms of elements are found now and again. Definitions might, in some cases, be bettered. Thus the definition of combustion as 'the result of the union of two or more substances' will never do. A mixture of brandy and water or the union of copper and zinc to form brass would, on this showing, be a case of combustion. Again, on page 64, the definition of atomic weight includes a blunder that, though merely verbal, is vital, and calculated to mislead a student very seriously. And on the succeeding page a number of formulæ are given that are supposed to illustrate atomicity, while not a word is said as to whether the whole or a part—and if so, what part—of the formulæ given is to be taken as illustrative of the difference between monads, dyads, and their fellows.

But perhaps the most fatal omission made by Mr. Ripper is that of the use of the unitary method. He solves all his sums by the antiquated, cumbrous, and isolated rule of three. The full meaning of this anachronism will only be grasped by the students of modern mathematics and chemistry. The unitary method is the soul of the arithmetic of practical work to-day, and the sooner Mr. Ripper and—what is more important to him—his pupils are familiarised with this valuable method of solving problems of so many kinds, the better for all parties concerned.

And yet, after all our adverse criticisms, we are bound to confess that the book is of distinct practical value. Not, as we said at the outset, so much for the teacher, but for the large number of students who are working at the subject of chemistry without a master. We should not be justified in saying that in this book they will find the teaching of a master of chemistry. But they will have the fairly able guiding of one who has at least encountered the difficulties with which they will have to meet.

Picciola. By X. B. Saintine. Edited by Dr. Dubuc. London: G. Bell and Sons, Covent Garden.

The question is now being gravely considered, whether or not it is advisable that special books should be given for preparation for examinations? We do not venture to give any opinion on the subject, but we are heartily glad that, for the next few months, all our boys and girls preparing for the Junior Cambridge Local Examination of December will be studying *Picciola*. No one could fail to be the better for reading this story, which is written in pure and elegant French, touched with the true spirit of poetry, and surrounded with an air of refinement which is rare in French works of fiction. And those who are studying *Picciola* cannot do better than avail themselves of Dr. Dubuc's annotated edition. From grammars we can learn the agreement and relation of words, and from dictionaries we can find the English equivalents to French words, but there are still many subtle shades of meaning and idiomatic renderings which can only be learned from oral instruction, or such notes as we find in Dr. Dubuc's *Picciola*. Take, for instance, the passage, 'rays of happiness appeared (*apparaissaient*) at intervals'; few French students would realise the aptness of the use of the verb *apparaître* instead of *paraître*, but at the foot of the page it will be pointed out that the latter has a vague meaning of 'to appear,' while the former speaks of things which appear like spirits and vanish, and is therefore a fitting term to express the notion of a passing ray of happiness. This is only one of the many examples we might give; but we hope it will be sufficient to show that Dr. Dubuc has not given copious translations to save students the trouble of looking out things for themselves, but that he has supplied us with 'explanatory and critical remarks.'

Farnsworth's Domino Sheets for Infant Schools. Nos. 1 and 2. Manchester: J. Ledsham. London: Simpkins.

The emphatic commendation which we recently bestowed upon the 'Domino Cards,' we should not hesitate to repeat with regard to these two large sheets which represent collectively the 'domino dots' as symbols of number in various combinations up to eighteen. The presentation of these 'sums' on the walls of a Kindergarten or infants'-school would alone attract some attention; but where the 'cards' are in use the sheets will serve as a constant means of revisal or explanation. We believe that the author's claim that they 'produce excellent results' is allowed wherever they have been intelligently used, because of the easy application of the principle on which they are based and the consequent economy of time. The sheets are mounted on rollers, and we advise those who wish to teach little children 'number' instead of figures to take the earliest opportunity to inspect them.

Elementary Lessons in the Principles of Agriculture. By W. J. Harrison. First Stage. T. Nelson and Sons, Paternoster Row.

This is a very clearly written introduction to the study of agriculture, specially adapted to the requirements of the New Code of 1882.

The subject is well defined and clearly stated; and, wherever possible, experiments illustrative of the subject-matter are described.

The chemical facts involved are carefully explained, and chemical changes are described without the use of formulæ.

The value of the book is greatly increased by the beautiful illustrations it contains. We notice a rather loose definition of 'physiology'; 'it treats of the structure and life of animals.' Of course physiology may be either animal or vegetable; and, strickly speaking, it only treats of the functions and not of the structure of living organisms.

On the next page we notice an incorrect statement of the relation of organisation to life. It is not true that everything possessed of life has distinct organs, although that protoplasm is essential for the presence of life, but this may be absolutely undifferentiated.

The book, as a whole, is thoroughly reliable, and may be heartily recommended.

Warming and Lighting the Dwelling: their Bearing on Health and Disease. By J. Angell, F.C.S. London and Manchester: J. Heywood.

This little pamphlet forms one of a series of health lectures given under the auspices of the Manchester and Salford Sanitary Association. The value of such lectures cannot be too highly estimated. The diffusion of valuable scientific and sanitary knowledge they are producing must lead to increased happiness and health in the vast population of Manchester, and these lectures will well repay reading by a much larger circle.

This particular lecture deals with an important subject in a simple and yet scientific way, and details many experiments that might easily be reproduced by any teacher, and form the groundwork of one or several very valuable lessons.

The author has evidently a weakness for the good old English open fires in preference to any closed stoves or hot-air or hot-water apparatus; and we confess to sharing his preference. The objections to other plans of heating are well put.

As regards lighting, the author seems to prefer gas even to the incandescent electric light for ordinary use, considering that the power of the heated gas to aid ventilation is an important argument in its favour. But as a matter of fact, except in the case of sunlights, the heated and polluted gases resulting from the burning of gas do not escape from the room, but remain and render it hot and close. And if we are to have ventilating-shafts to render gaslights compatible with pure air, there is no difficulty having them likewise along with the electric light.

We are glad to see some of the most obnoxious of gas-stoves exposed as they deserve to be, and the statement that no flues are required with them shown to be fallacious.

Latin Course. Second Year. By T. T. M'Lagan, M.A. Chambers' Educational Course. London and Edinburgh: W. and R. Chambers.

This is likely to prove a very serviceable little manual for both class and private work. The arrangement is similar to that pursued in the First Year's Course, and is, in our opinion, clear and workmanlike. It commences with the irregular verbs, and then, after treating in detail the remaining parts of speech, gives rules and explanations for the guidance of the student in those difficulties which beset his path in the elementary study of the language. The exercises form the second part of the book, and are copious and carefully graduated. A vocabulary containing the Latin words which occur throughout forms an appropriate and useful ending to a commendable little book.

Reprints of English Classics. Scott's 'Lord of the Isles.' Canto I. With Life and Notes. London and Edinburgh: W. and R. Chambers.

To review such a well-known poem is unnecessary: a description of the style in which this reprint is produced is all that the case demands. To those preparing for examination this publication will be of great service, as the notes are full and thorough and contain all the information necessary for the due understanding of the text. The biography of the distinguished author at the commencement of the publication and the notes on the metre of the poem at the end are also very serviceable features.

The Musician: a Guide for Pianoforte Students. By Ridley Prentice. In Six Grades. Grade I. W. Swan Sonnenschein and Co., Paternoster Row.

An excellent little book. We have read it through with much pleasure, and look forward with interest to the publication of the succeeding grades. Mr. Ridley Prentice, who is himself an accomplished pianist and experienced teacher, has addressed his book to learners of the pianoforte 'who *study*,' and to those 'who merely *practise* in a mechanical way,' as a help 'towards the better understanding and enjoyment of beautiful music.' The design of the book is admirably carried out in a series of lessons written in an attractive conversational style, interspersed with interesting anecdotes, and so arranged that with each lesson some new idea or explanation is introduced. In addition to the pieces analysed, a complete list of pianoforte pieces is given, arranged in progressive order of difficulty, and suitable for students of the First Grade; while another excellent feature of the book is a list of musical works valuable to students of all grades, with a short paragraph indicating the special character of each work.

As an introduction to musical 'forms,' and the intellectual appreciation of classical compositions, the work before us cannot fail to be exceedingly useful to both teachers and pupils. In about eighty pages, Mr. Prentice gives us an amount of information usually found only in works of an advanced character, and presented in such a practical and attractive form that the learner is relieved of all the difficulties of a dry technical study.

Standard Reading Book. No. 5. The Granville Series. London: Burns and Oates.

This book is well adapted to the purposes for which it is intended. It is serviceably bound and well printed, and the contents are written in a bright, interesting style, which will go far to make the reading-lesson a pleasure to children rather than a task. There is a fair sprinkling of poetry interspersed throughout, and the pages are enlivened with some creditable woodcuts. We may add that each chapter is preceded by a short explanatory list of the difficult words occurring in it.

*** *Several reviews are crowded out.*

—o—

Music.

BY RALPH DUNSTAN, MUS. BAC., CANTAB.; L. MUS., T.C.L.;

Member of the Council of the Tonic Sol-fa College, etc.

IN building a house, the first and most important consideration is 'a good foundation.' When this is secured the walls are raised upon it, then the roof is put on, and finally the details, doors, windows, etc., are added.

It is precisely the same in constructing or 'composing' a tune. A musical tone is first chosen as the foundation upon which the whole musical structure has to rest; other tones are then selected having certain definite relations to this particular tone, and finally these selected and relative tones are arranged so as to 'please the ear' and produce 'a tune.'

Music is founded upon 'scales.'

SCALE AND KEY.—A scale is a set of tones arranged with the names in 'alphabetical' order, as C, D, E, F, G, A, B, C, etc.

Fig. 14.

When a scale is fixed to some particular pitch, the music is said to be in the 'key' determined by this pitch.

KEY-TONE, OR TONIC.—The tone chosen as the 'foundation,' or 'governing tone,' of a tune is called the *Key-tone*, or *Tonic*, the note representing it being called the *Key-note*, or *Tonic*.

N.B.—The terms 'tone' and 'note' are often used synonymously in referring to musical sounds.

The note selected for the 'Tonic' tells us the key: thus, if C is the tonic, the music is said to be in the 'key of C'; if D is the tonic, 'key of D,' etc.

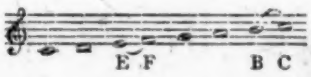
All the other tones of a tune have well-defined and invariable relations to the key-tone, or tonic.

ABSOLUTE AND RELATIVE PITCH.—We have before spoken of 'Pitch' as being determined by the number of vibrations in a given period. Pitch measured in this way is said to be 'absolute' or 'fixed'; thus 'middle C' (256 vibrations per second), represents a tone with 'absolute' pitch. If we increase or lessen the rapidity of the vibrations the absolute pitch changes, but while the number of vibrations remains constant the pitch is invariable. When, however, we compare tones of different pitches, we speak of one as being *higher* or *lower* than another, and in making this comparison use the term 'relative pitch.' Thus, though the pitch of a tone may be 'absolutely' *high*, it may be 'relatively' *low* when compared with another or others in the same piece of music.

THE COMMON SCALE.—Most tunes are founded upon what is called the 'Common Scale,' which is a *ladder* of tones arranged in definite order upon the key-tone, or tonic.

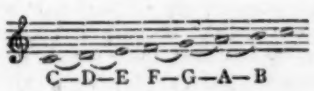
It is very important to understand clearly the construction of the 'scale,' and the student is advised to master it thoroughly before proceeding further.

The term 'Interval' is used to express the difference of pitch between any two tones. The smallest interval used in music is called a 'semitone,' and is approximately indicated on the piano or harmonium by any key and the *next* to it (white or black). There are *two* such intervals in the 'common scale'—viz., between E and F, the third and fourth notes of the scale, and between B and C, the seventh and eighth.

Fig. 15.  (Scale of C.)

E F B C

A larger interval, called a 'tone' (two semitones), lies between the other consecutive notes of the scale—viz., between C and D, D and E, F and G, G and A, A and B.

Fig. 16.  (Scale of C.)

C—D—E F—G—A—B

We have selected what is called the scale of C, or the 'Standard' scale for our illustration, and the unchangeable order of tones and semitones as shown in this scale is observed in every other common scale.

(Intervals in Common Scale.)

Fig. 17.

The 'eighth' note, you will remember, is the octave or repetition of the first; and starting again from this, the same order of tones and semitones is observed in every subsequent octave. (The term 'octave' is applied not only to the 'eighth note,' but also to the *scale* of eight notes.)

EXERCISE 4.—Commit to memory:—In the common scale the interval

between the 1st and 2nd notes is a tone,
" " 2nd " 3rd " " tone,
" " 3rd " 4th " " semitone,
" " 4th " 5th " " tone,
" " 5th " 6th " " tone,
" " 6th " 7th " " tone,
" " 7th " 8th " " semitone.

TONIC SOL-FA.—In the Tonic Sol-fa notation the tonic of *any* scale is called DOH, written d, and the other notes of the scale, in order, are RAY, ME, FAH, SOH, LAH, and TE; written r, m, f, s, l, t.

On a chart called the 'Modulator' the common scale is represented as follows:—

Fig 18. Modulator, showing Common Scale in Tonic Sol-fa names:—

DOH¹
TE
LAH
SOH
FAH
ME
RAY
DOH

ME and FAH, the third and fourth, and TE and DOH¹, the seventh and eighth notes of the scale are printed close to each other, showing the position of the *semitones*, wider spaces being left between the other notes to indicate the *tones*. In this way, the Modulator is a *pictorial* representation of the scale.

OCTAVES or REPLICATES in SOL-FA are shown by figures placed to the right of the name of the note, either above, d^1, or below, d_1; the note an octave *above* d is written d^1, two octaves above, d^2, etc.; an octave below is written d_1, two octaves below, d_2, etc. These figures are always read *downwards* with the name of the note, thus d^1 is called ONE-DOH; d^2, TWO-DOH; d_1, DOH-ONE; and d_2, DOH-TWO, etc.

SHARPS AND FLATS.—The notes C, D, E, F, G, A, B, suffice for the scale of C, and represent it on the staff; but when it is desirable to change our 'tonic,' or 'key-tone,' one or more of these notes must be modified. A 'sharp,' ♯, placed before a note raises its pitch a *semitone*; a 'flat,' ♭, before a note lowers it a semitone; and a 'natural,' ♮, restores a note previously altered to its original or normal pitch in the scale of C. *All* the notes in the scale of C are 'naturals,' and it is therefore often called the natural scale; but we only speak of 'C natural,' 'F natural,' etc., when we wish to distinguish these notes from the 'flats' or 'sharps' of the same name. In other words, a note is always understood to be a 'natural' unless a sharp or flat is specially signified. Occasionally a 'double sharp,' X, or a 'double flat,' 𝄫, is employed, raising or lowering a note *two* semitones. It is often asserted that 'C sharp' and 'D flat' are different names for the same sound. This is true when speaking of the pianoforte, the tuning of which will be explained later on, but it gives a very erroneous and confused impression to young students; and, therefore, from the beginning it should be clearly understood that the *sharp of any one note is theoretically quite distinct from the flat of the next note above*, and it is a very serious mistake to *write*, for example, 'G flat' instead of 'F sharp.'

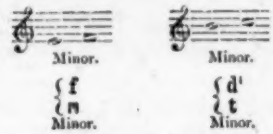
INTERVALS FOUND IN THE COMMON SCALE.—We have already spoken of the intervals of 'tones' and 'semitones' found between *consecutive* notes of the scale. It is evident, however, that many other intervals exist in the scale, as, for example, from C to E, from F to B, or from d to m, from f to t, etc. Intervals are reckoned as to (1) name, and (2) quality.

The NAME OF AN INTERVAL is determined by the number of consecutive notes it includes, reckoning the *first and the last* in this number: thus, the interval C to D, including *two* alphabetical or letter names, is called a '*Second*,' C to E, including *three* names C, D, E, is called a 'Third,' etc. Intervals are always read *upwards* unless the contrary is specified, D being a 'second above' C, E a 'third above' C, etc.

QUALITY OF AN INTERVAL.—If we write down all the 'Seconds' in the scale—viz., C-D, D-E, E-F, F-G, G-A, A-B, B-C, or d to r, r-m, m-f, f-s, s-l, l-t, t-d, we have in all 'seven' seconds; but you will remember that these Seconds are not all equal in value: some are *semitones* (E-F, B-C, m-f, t-d), others are *tones*. The smaller seconds are said to be 'Minor,' the larger 'Major,' the terms Major and Minor defining the 'quality' of the intervals.

TABLE OF SECONDS:—

Five Major Seconds.



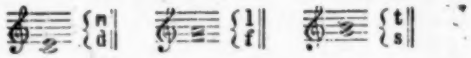
Two Minor Seconds.

THIRDS, MAJOR AND MINOR.—An interval of a third includes *three* names: as C to E (including C, D, E), A to C (including A, B, C); r to f (including r, m, f), etc.

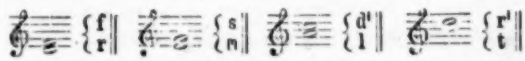
The Thirds (seven in number), found in the common scale, comprise either two Major seconds or one Major and one Minor second: the larger interval is called a 'Major Third'; the smaller a 'Minor Third.'

Sometimes intervals are computed in semitones; thus a Minor third contains *three* semitones, a Major third contains *four* semitones.

TABLE OF THIRDS.—'Three' *Major* thirds, comprising two Major seconds, or *four* semitones:—



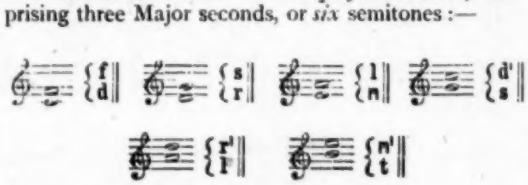
'Four' *Minor* thirds, comprising a Major and Minor second, or *three* semitones:—



FOURTHS, PERFECT AND PLUPERFECT OR AUGMENTED.—In speaking of 'fourths' (C to F, F to B, d to f, f to t, etc.) the terms 'Major' and 'Minor' are not used. Formerly *all* intervals were divided into two classes, 'imperfect' and 'perfect,' but these terms are now used only of fourths, fifths, and octaves. (The exact meaning of 'perfect' as applied to intervals will be explained in a subsequent chapter.)

All the fourths in the 'Common Scale,' with *one* exception, are 'perfect'; this exceptional interval must, therefore, be well known and carefully distinguished.

TABLE OF FOURTHS.—'*Six*' *perfect* fourths, comprising three Major seconds, or *six* semitones:—



One 'pluperfect' fourth, comprising three Major seconds, or *six* semitones:—

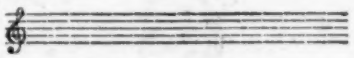
'Pluperfect' means 'greater than perfect'; this interval is often called an 'augmented' fourth; and sometimes a 'tritone,' because it contains 'three' whole tones. It has, then, three names, each of which should be remembered: (1) Pluperfect, (2) Augmented, (3) Tritone.

Notes are often said to 'bear' certain intervals; this term will be readily understood by referring to the scale and remembering the following:—d, r, f, s, and

l 'bear' Major seconds; m and t bear Minor seconds; d, f, and s bear Major thirds; r, m, l, and t bear Minor thirds; d, r, m, s, l, and t bear perfect fourths; f bears a plu-perfect or augmented fourth, or tritone.

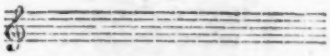
The following exercises are given in both notations, those in Sol-fa being printed in italics :—

Ex. 5. Write the notes of the scale of C which bear Major seconds.



Write the notes of the scale which bear Major seconds.

Ex. 6. Write three examples of a Major third, and four examples of a Minor third.



Write out all the Major thirds in the scale and all the Minor thirds in the scale.

Ex. 7. Write *underneath* each of the following pairs of notes the name and quality of the included interval, and *above* each the number of semitones contained in the interval.

Write UNDERNEATH *each of the following pairs of notes the name and quality of the included interval, and* ABOVE *each the number of semitones included in the interval.*

s :—	t :—	m :—	r' :—	d' :—	f :—	m' :—	
m :—	s :—	r :—	d' :—	s :—	m :—	d' :—	

r :—	d' :—	d' :—	t :—	m' :—	f :—	f :—	
t, :—	l :—	t :—	f :—	t :—	d :—	r :—	

l :—	s :—	r' :—	l :—	s :—	t :—	l :—	r' :—
f :—	f :—	t :—	s :—	r :—	l :—	m :—	l :—

(*To be continued.*)

—o—

Physiology.

BY ARTHUR NEWSHOLME, M.D. LOND.,

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CHAPTER III.—(*continued*).

Jelly-like connective tissue or mucous tissue is a variety of connective tissue, in which the embryonic condition is maintained. At an early period in the life of the fœtus, connective tissue consists of a jelly-like material, in which nucleated corpuscles are imbedded. The soft jelly contains *mucin*, a chemical substance characteristic of mucus, but it does not contain gelatin. As a rule, fibres, both white and yellow, appear in this jelly-like material, and the latter disappears; but in some cases the cells may disappear and only the jelly remain, as we see in the vitreous humour of the eye; or the cells and jelly may both persist, a few fibres of white and yellow fibrous tissue being developed in addition, as is seen in the jelly of Wharton, which forms a large part of the umbilical cord.

Retiform connective tissue, or *adenoid tissue*, as it is sometimes called, differs from jelly-like connective tissue, in the fact that all the mucous material has disappeared, and the cells forming the remainder of the tissue have united by branches with one another, so as to form a delicate network—hence the name of retiform tissue. The branches of the cells may persist, and the central main mass disappear, or the two may remain together. Retiform tissue is called adenoid tissue, because it forms a great part of the structure of glands, like the spleen and all lymphatic glands. In the meshes of which retiform tissue consists, small cells resembling white blood corpuscles are generally imbedded. Besides occurring in various glands, it also forms a framework supporting the essential parts of various organs. Thus, in the brain and spinal cord, it is present under the name of neuroglia, supporting the delicate nerve cells and fibres.

Recapitulating, we find that the main varieties of connective tissue are—

(1) Ordinary connective or areolar tissue, consisting of varying proportions of white and yellow fibrous tissue, along with connective-tissue corpuscles.
(2) White fibrous tissue.
(3) Yellow fibrous or elastic tissue.
(4) Adipose tissue.
(5) Jelly-like connective tissue.
(6) Retiform connective tissue.

The other elementary tissues, namely, cartilage, bone, muscle, nerve cells and fibres, will be studied in detail when we treat of the systems to which they belong. In the present chapter we have considered only epithelium and connective tissue, which do not belong exclusively to any one organ.

PRACTICAL WORK.

As it is very important that the tissues already described should be *seen* and examined by each student, we give here a few hints as to their preparation for viewing under the microscope.

1. Make an emulsion of albumen and oil as described in the text, and examine the minute globules under the microscope. Also examine a drop of milk to compare with this. A drop of either of these is placed on a glass-slide, 3 by 1 inch, which can be obtained at any scientific instrument maker's shop under the name of 'microscopic slides,' and over the drop of liquid a very thin 'cover-glass' is placed, about ¾ inch wide. In lowering the cover-glass care must be taken to do it slowly, or air-bubbles will be enclosed in the specimen, and confuse the novitiate at microscopic work, as well as allowing the specimen to decompose in the case of more important mounts.

2. Remove the omentum of a cat, and after washing carefully, place it in a ½ per cent. solution of silver nitrate for one to three minutes, and then expose it to daylight until it turns slightly brown. A drop of glycerine is now placed on a slide, and a very thin layer of a bit of the omentum is placed in this and covered with a cover-glass. The endothelium will then be visible.

3. Scrape the surface of your skin with a blunt

knife, and put the scrapings in a little solution of caustic potash on a slide. After leaving for half-an-hour, put a cover-glass over it, and examine for squamous epithelium.

4. Ciliated epithelium may be seen, and the ciliary movement watched by scraping the top of the gullet of a frog with a knife directly after it has been killed, and then placing the scrapings in a ¾ per cent. solution of salt; or by scraping the mucous membrane of the windpipe of a cat directly after death.

5. The ligamentum nuchæ of a calf may easily be obtained from any butcher. Take a very minute piece of it, put it in a drop of water, and by means of two needles tease out and separate the tiny fibres of which it is composed. Then examine under the microscope.

Next remove the cover-glass, add a drop of acetic acid, and after a few minutes, examine again. There is no difference.

6. To examine areolar tissue, take a little of the filmy tissue found under the skin of a rabbit before cooking. Spread this out carefully, and examine under the microscope. Next take off the cover-glass, and add a drop of acetic acid. The white fibres swell up and disappear, only a clear jelly remaining. A few yellow fibres may be seen, and the nuclei of some connective-tissue corpuscles.

7. The omentum of a cat in many parts contains abundant adipose tissue, which can be examined.

CHAPTER IV.—THE SKELETON.

WE have seen in our general review of the build of the body that the skeleton forms a framework on which the rest of the body is supported. Not only does it *support* the soft parts of the body, but also *protects* important organs from injury. The arched and consequently elastic ribs protect the heart and lungs from injury by blows or pressure on the chest. The bones of the skull form a box in which the brain is safely protected. Again, the bones of the skeleton serve for the attachment of muscles, which in contracting move one of the two bones to which they are usually fixed. In this way bones (especially long bones) serve as *levers*. If you look at the skeleton you will see that the general outline of the body is regulated by it. It regulates, to a large extent, the shape of the body.

On looking at Fig. 11, or better still at the real skeleton, you will see that it consists of:

1. A column running down the back—the *spinal* or *vertebral column*.

2. *Three bony cases* enclosing cavities; which are the *skull*, resting on the top of the vertebral column, and really formed by a modification of vertebræ; the *thorax*, formed by the sternum anteriorly, and the ribs laterally—the ribs joining the vertebral column behind; and the *pelvis*, a basin-like cavity, formed by the two innominate bones joining with the lowest part of the vertebral column behind and with one another in front.

3. The *four limbs*—arms and legs.

The number of bones included under these various heads amounts to 210. There are many bones which, though apparently one, are really composed of several bones joined together. In the skull, for instance, there are really thirty-one bones, or including the hyoid bone (just above 'Adam's apple' in the throat) thirty-two.

Of the 210 bones of the skeleton,

32	belong	to	the skull,
24	„	„	vertebral column
4	„	„	pelvis,
64	„	„	two upper limbs,
62	„	„	two lower limbs.

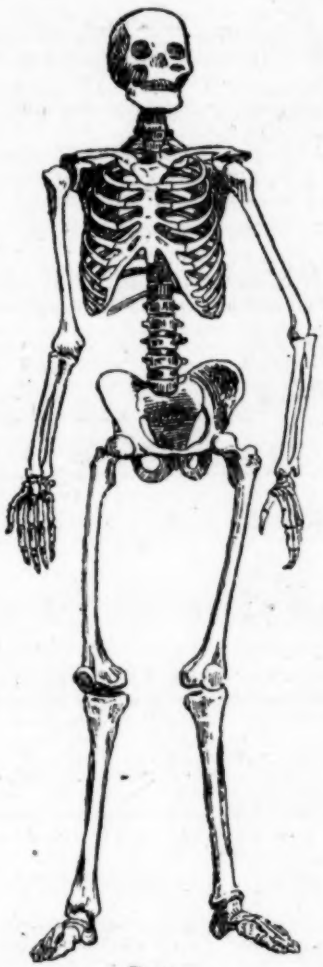

Fig. 11.

A glance at the skeleton will show you that there are various *kinds of bones* in it. Some of them are *long*, like most of the bones of the extremities; others are *short*, like the vertebræ and the bones of the carpus and tarsus; and others are *flat*, like the hip bones and the bones of the vault of the skull. The place where two bones join together forms a *joint* or articulation, and there are various kinds of joints, according to the degree and kind of movement allowed.

Long bones serve as stiff levers on which muscles can act; short bones occur where many joints are required, in order to allow of more delicate movements; and flat bones usually form the boundaries of cavities, as in the skull and pelvis.

(*To be continued.*)

Christmas Certificate Examination, 1882.

(Continued from page 122.)

MALE AND FEMALE CANDIDATES (FIRST YEAR).

Languages.

FOUR *hours allowed for this Paper for Male Candidates;* THREE *hours for Female Candidates.*

Male Candidates may answer questions in *two* Languages, *Female* Candidates in *one* only.

N.B.—German words must be written in English characters.

French.

SECTION II.

Translate into French :—

(*a*) The unhappy man trembled with cold.

(*b*) How long does a letter take to go from here to Fenestrelle?

(*c*) The third day passed and the girl had not come back.

(*d*) 'Are you making game of me?' said the Empress.

(*e*) Charney darted a look of contempt at his jailer; then he bethought him, at the old man's words, of the interest which the young Piedmontese maiden had already shown in him.

(*f*) The landlady sent her stable-boys about the town, but it was to no purpose that they ran through it in every direction; all the conveyances had already departed or were engaged, and nothing remained for her but to wait till the mail post should arrive.

ANSWERS.

(*a*) Le malheureux frissonna (de froid).

(*b*) En combien de temps est-ce qu'une lettre peut aller d'ici à Fenestrelle?

Or, Combien de temps faut-il à une lettre d'aller d'ici à Fenestrelle?

(*c*) Le troisième jour s'écoula sans que la fille fût de retour.

(*d*) 'Est-ce que vous vous jouez de moi?' dit l'Impératrice.

(*e*) Charney lança un regard de mépris à son geôlier, alors il se rappela, au dire du vieillard, l'intérêt que lui avait déjà témoigné la jeune Piémontaise.

(*f*) L'hôtesse envoya ses garçons par la ville, mais ils eurent beau la parcourir dans tous les sens; toutes les voitures eurent déjà parties, ou bien étaient retenues à l'avance, et il ne lui restait rien que d'attendre jusqu' à ce que la malle poste arrivât.

SECTION III.

1. State the most general rule for the formation of the feminine in French adjectives, and give the feminine form of each of the following when it does not conform thereto :—Beau, sec, heureux, prudent, vieux, blanc, Grec. Put into French, 'The new boy-scholar (écolier)—The new girl-scholar.'

2. Make a table exhibiting the third persons singular and plural of the principal tenses indicative and the present and past participles of the following verbs :—parler, savoir, être, aller, mourir, s'asseoir.

3. Give the rule for the agreement of the past participle, and express in French :—'My aunts have gone into the garden—They have given us some roses—These are the roses which they have us.'

ANSWERS.

1. The most general rule for the formation of the feminine adjective is *by adding e* to the masculine. Ex. : *grand, grande; petit, petite.*

Masculine.	*Feminine.*
beau	belle
sec	sèche
heureux	heureuse
vieux	vieille
blanc	blanche
Grec	Greque.

Le nouvel écolier.
La nouvelle écolière.

2. INDICATIVE MOOD.

	Present.	*Imperfect.*	*Preterite Definite.*
Sing.	il parle	il parlait	il parla
Plu.	ils parlent	ils parlaient	ils parlèrent.
Sing.	il sait	il savait	il sut
Plu.	ils savent	ils savaient	ils surent
Sing.	il est	il était	il fut
Plu.	ils sont	ils étaient	ils furent.
Sing.	il va	il allait	il alla
Plu.	ils vont	ils allaient	ils allèrent
Sing.	il meurt	il mourait	il mourut
Plu.	ils meurent	ils mouraient	ils moururent.
Sing.	il s'assied	il s'asseyait	il s'assit
Plu.	ils s'asseient	ils s'asseyaient	ils s'assirent.

Present Participle.	*Past Participle.*
parlant	parlé, fem. parlée
sachant	su, fem. sue
étant	été
allant	allé, fem. allée
mourant	mort, morte
s'asseyant	(s')assis, (s')assise.

3. The past participle agrees in gender and number with the subject of the sentence, when the verb is conjugated with être either expressed or understood.

Ex. *La dame est venue.*
La lettre écrite par la dame.

The past participle of a verb conjugated with *avoir* is invariable, unless preceded by its direct object, when it agrees with that object in gender and number.

Ex. *La dame a écrit une lettre.*
La lettre que *la dame a écrite.*
Mes tantes sont allées au jardin.
On nous a donné des roses.
Voici les roses qu'on nous a données.

German.

SECTION I.

1. Translate into English :—

(*a*) Vorgestern hatten wir ein gewaltiges Wetter mit Donner Blitz und Regengüssen; jetst hat sich's wieder aufgehellt, eine herrliche Tramontana weht herüber; bleibt sie beständig, so haben wir die schnellste Fahrt. Gestern war ich mit meinem Gefährten unser Schiff zu besehen und das Kämmerchen zu besuchen, das uns aufnehmen soll. Eine Seereise fehlte mir ganz in meinen Begriffen; diese kleine Ueberfahrt, vielleicht eine Küstenumschiffung, wird meiner Einbildungskraft nachhelfen und mir die Welt erweitern.

(*b*) Wir bestiegen die Kuppel und besahen die hell-heitere Gegend der Apenninen, den Berg Soracte, nach Tivoli die vulkanischen Hügel, Frascati, Castelgandolfo und die Plaine, und weiter das Meer. Nahe vor uns die ganze Stadt Rom, in ihrer Breite und Weite mit ihren Bergpalästen, Kuppeln, etc. Es rührte sich keine Luft und in dem kupfernen Knopf war es heiss wie in einem Treibhause. Nachdem wir das alles beherzigt hatten, stiegen wir herab, und liessen uns die Thüren zu den Gesimsen der Kuppel, des Tambours und des Schiffs ausschliessen; man kann um selbe herumgehen und diese Theile und die Kirche von oben betrachten. Als wir auf dem Gesimse des Tambours standen, ging der Papst unten in der Tiefe vorbei, seine Nachmittagsandacht zu halten. Es fehlte uns also nichts zur Peterskirche.

2. Parse the words bestiegen, fehlte, nachhelfen, schnellste, liessen, aufnehmen, hat sich's aufgehellt, and give the principal tenses of the verbs,—and decline die ganze Stadt in the singular and plural.

ANSWERS.

(*a*) We had a terrible storm the day before yesterday, with thunder and lightning, and torrents of rain; now it has cleared up again, and a beautiful breeze from over the mountains is blowing across; if it continues steadily blowing, we shall have a very quick passage. I went yesterday, with my companion, to have a look at our vessel and see the little cabin which is to

receive us. I can form no idea of what a sea-voyage is like; this short passage, with perhaps a little coasting along the shore, will assist my power of imagination, and enlarge my world.

(*b*) We ascended the dome and viewed the clear bright region of the Apennines, the Mount Soracte, and towards Tivoli, the Volcanic hills, Frascati, Castelgandolfo, and the plain, and beyond it the sea. We saw close before us the whole town of Rome, in its breadth and width, with its mountain palaces, domes, etc. There was no breath of wind, and it was as hot in the brazen top of the dome as in a hot-house. When we had taken it all in, we descended, and got them to open for us the doors to the ledges of the dome, the vestibule, and the nave; one may go round alone, and inspect these parts of the building, and the church from above. As we stood on the ledge of the vestibule, the Pope passed by at the bottom below us to perform afternoon service. So nothing was wanting to make St. Peter's perfect.

2. *bestiegen*—Indicative mood, preterite tense of the active verb, *besteigen*, strong conjugation of verbs, 1st person plural, agreeing with its subject *wir*.

fehlte—Indicative mood, preterite tense of the impersonal verb *fehlen*, weak conjugation, 3rd person singular, agreeing with *es*, which takes the place of its real subject *nichts*.

(*wird*) *nachhelfen*—Indicative mood, 1st future tense of the compound active verb *nachhelfen*, 3rd person singular, agreeing with its subject *Ueberfahrt*.

schnellste—Superlative degree of the adjective *schnell*, feminine singular, being used to qualify the fem. sing. noun *Fahrt*.

liessen—Indicative mood, preterite tense of the auxiliary verb *lassen*, strong conjugation, 1st person plural, agreeing with its subject *wir* (understood).

aufnehmen—Infinitive mood of the compound active verb *aufnehmen*, governed by the auxiliary of mood *soll*, strong conjugation.

hat sich's aufgehellt—'s = es. Personal pronoun, 3rd person singular number, neuter gender, nominative case, subject to the predicate *hat aufgehellt*.

hat sich aufgehellt—Indicative mood, perfect tense of the compound reflective verb *sich aufhellen*, weak conjugation, 3rd person singular, agreeing with its subject *es*.

PRINCIPAL PARTS OF THE VERBS.

Infinitive.	Indicative. Present.	Indicative. Preterite.	Perfect Participle.	Imperative.
besteigen	ich besteige	ich bestieg	besteigen	besteige.
fehlen	es fehlt	es fehlte	gefehlt	hilf nach.
nachhelfen	ich helfe nach	ich half nach	nachgeholfen	
lassen	ich lasse	ich liess	gelassen	lasse.
sich aufhellen	es hellt sich auf	es hellte sich auf	aufgehellt	

	Singular.	*Plural.*
N.	Die ganze Stadt.	Die ganzen Städte.
G.	der ganzen Stadt.	der ganzen Städte.
D.	der ganzen Stadt.	den ganzen Städten.
Ac.	die ganze Stadt.	die ganzen Städte.

SECTION II.

Translate into German:—

(*a*) Have the goodness to show me the way.

(*b*) The houses in Pompeii are small and confined, but all painted in the neatest manner within.

(*c*) Yes! I have at last arrived in the capital of the world.

(*d*) There also we saw the fish that gives an electric shock to those who handle it.

(*e*) Last night I dreamt that I was again at Weimar.

(*f*) Two hours before night the full moon had risen and made the evening unspeakably glorious.

Arrange the words of the following sentence in the order in which they would stand in a narrative in German:—

Those	three	houses	of-mine	so	new
Jene	drei	Häuser	meine	so	neuen
and beautiful	were	entirely	sacked	by	
und schönen	sind—worden	rein	ausgeplündert	von	
the	all	destroying	enemy	in	the	last
dem	alles	zerstörenden	Feinde	in	dem	letzten
war	(which was)	so	desolating.			
Kriege		so	verheerenden.			

ANSWERS.

(*a*) Gefälligst, weisen Sie mir den Weg.

(*b*) Die Häuser von Pompeji sind klein und eng, aber alle drinnen auf der zierlichsten Art gemalt.

(*c*) Ja wohl! Endlich bin ich auf die Welthaupstadt angekommen.

(*d*) Da sahen wir auch den Fisch, der, denjenigen die ihn anfassen einen elektrischen Stoss anführen.

(*e*) Diese Nacht träumte ich dass ich wieder zu Weimar sei.

(*f*) Zwei Stunden vor der Nacht war der Vollmond aufgegangen, und derselbe hatte den Abend unsäglich herrlich gemacht.

Jene meine drei so neuen und schönen Häuser sind, in dem letzten so verheerenden Kriege, von dem alles zerstörenden Feinde rein ausgeplündert worden.

SECTION III.

1. What is the rule for the formation of the plural in monosyllabic German nouns which end in a consonant, and whose vowel is *a* or *o* or *u*? Can you mention any exceptions?

2. Make a table of declensions, singular and plural, of the personal and reciprocal pronouns, *ich*, *er*, *du*, and *sich*.

3. Give the first and second persons singular of the present and preterimperfect tenses, and the participles, of the verbs *loben*, *brechen*, *können*, *nehmen*, *müssen*.

4. Name the auxiliary verbs, and illustrate their use in the formation of moods and tenses.

5. What English terminations correspond to each of the following German terminations:—*thum*—*schaft*—*ung*—*keit* or *heit*—*tät*—*inn*—*chen* or *lein* and *lich*—*los*—*isch*—*bar*—*voll*—*st*, and give examples in each language.

ANSWERS.

1. German monosyllabic nouns ending in a consonant whose vowel is *a*, *o*, or *u*, form their plural by adding *e* to the singular, masculines and feminines generally modifying the vowel, neuters never. *Der Sohn, die Söhne; die Nacht, die Nächte; das Jahr, die Jahre.*

Exceptions.

(*a*) The following masculine monosyllables form their plural in *er*, vowel modification; *Gott, Mann, Ort, Rand, Wald, Wurm.* Plural, *Götter, Männer*, etc.

(*b*) Some masculine and feminine monosyllables once ended in *e*, and took the plural *n*; they still form their plural by adding *en* to the singular. Ex.: *der Graf, die Grafen; der Fürst, die Fürsten; die Bahn, die Bahnen; die Fahrt, die Fahrten.*

(*c*) Some neuter monosyllables form their plural in *er*, vowel modification; das *Amt, Bad, Dach, Dorf, Fass, Fach, Volk*, etc. [Plural, *Aemter, Bäder, Dächer, Dörfer*, etc.

2.

	Singular.	Plural.	Singular.	Plural.
N.	ich	wir	er	sie
G.	meiner	unserer	seiner	ihrer
D.	mir	uns	ihm	ihnen
Ac.	mich	uns	ihn	Sie

N.	du	ihr or Sie	Singular & Plural.	
G.	deiner	eurer ,, Ihrer	D.	Sich
D.	dir	euch ,, Ihnen	A.	
Ac.	dich	euch ,, Sie		

3.

	Indicative.	Subjunctive.
Present	ich lobe	ich lobe.
	du lobst	du lobest
Pret. imp.	ich lobte	ich lobte.
	du lobtest	du lobtest.

Participles.

Present lobend Past gelobt.

Present	ich breche	ich breche.
	du brichst	du brechest.
Pret.	ich brach	ich bräche.
	du brachst	du brächest.

Participles.

Present brechend Past gebrochen.

Present	ich kann	ich könne.
	du kannst	du könnest.
Pret.	ich konnte	ich könnte.
	du konntest	du könntest.

Past Participle.
gekonnt.

Pres.	ich nehme	ich nehme.
	du nimmst	du nehmest.
Pres.	ich nahm	ich nähme.
	du nahmst	du nähmest.

Participles.

Present nehmend. Past genommen.

Pres.	ich muss	ich müsse.
	du musst	du müssest.
Pret.	ich musste	ich müsste.
	du musstest	du müsstest.

Past Participle.
gemusst.

4. Complete auxiliaries: (1) *Haben*, to have; (2) *Sein*, to be; (3) *Werden*, to be, or to become.

Besides these there are six auxiliaries of mood, viz.: *Können, wollen, sollen, müssen, mögen, dürfen.*

(*a*) Haben and sein are used to form the compound tenses of transitive and intransitive verbs.

Ex.: Ich habe genommen. Ich bin gekommen.
Ich habe mich erkältet.

(*b*) *Werden* is used to form: (1) the future tenses of a verb (ex.: *Ich werde gehen* = I shall go); (2) the passive voice of a verb (ex.: *Ich werde geliebt* = I am loved).

(*c*) The six auxiliary verbs of mood are used with the infinitive of the verb.

Ex.: Ich kann gehen = I can go.
Ich will gehen = I *will* go.
Ich soll gehen = I ought to go.
Ich muss gehen = I am obliged to go.
Ich mag gehen = I like going.
Ich darf gehen = I am allowed to go.

(*d*) The above have the following peculiarities: when used in the compound tenses, the *infinitive* of the auxiliary is used, instead of the *past participle*.

Ex.: *Ich habe kommen müssen* = I have *been obliged* to come.
Ich hatte gehen können = I had been able to go.

5. English terminations corresponding to—

thum = dom.
Ex.: das Kaiserthum, kingdom (empire), Christendom.

schaft = ship or scape.
Ex.: die Freundschaft, friendship.
die Landschaft, landscape.

ung = ing.
die Ueberlieferung, the surrendering.
die Unternehmung, the undertaking.
die Nennung, the calling.

heit or *keit* = ty.
Ex.: die Schönheit, beauty.
die Freiheit, liberty.
die Einheit, unity.
die Eitelkeit, vanity.

tät = ty.
die Universität, university.
die Majestät, Majesty.
die Autorität, authority.

in = ine (a feminine termination).
die Heldin, heroine.
die Landgräfin, landgravine.

chen or *lein* = kin (diminutive).
Ex.: das Lämmlein, lambkin.
das Männlein, mannikin.

lich = ly (like).
Ex.: göttlich, godly.
lieblich, lovely.

los = less.
Ex.: grenzenlos, boundless.
wehrlos, defenceless.

isch = ish.
Ex.: kindisch, childish.
Spanisch, Spanish.

bar = ful.
Ex.: dankbar, thankful.
fruchtbar, fruitful.

voll = full.
Ex.: freudenvoll, joyful.

st = ly (superlative degree).
Ex.: äusserst, extremely.
höchst, highly.

British History.

Three hours allowed for this paper.

Candidates are not to answer more than EIGHT questions.

1. Give a brief account of *three* of the following persons:—Caradog (Caractacus), Boadicea, Agricola, Augustine, Dunstan, Edric the Traitor, Godwin, Simon de Montfort, Wallace, and Owain Glyndwr.

Caradog (Caractacus).—In A.D. 43 the Emperor Claudius sent Aulus Plautius against the Britons, following himself in a short time. The south-eastern portion of the island fell into their hands. Several of the chiefs were slain, the brother of Caradog being among them. Caradog was defeated in the Essex marshes, but fled to Wales, where he resisted the Romans for eight years. *Caer Caradoc*, his stronghold, was taken by Ostorius in 50, and he himself delivered to the Romans by his stepmother in 51. Being carried a prisoner to Rome, his liberty was granted him by the emperor, whose fast friend he became. He is supposed to have died in Rome.

Boadicea.—Queen of the Iceni, a tribe inhabiting Norfolk and Suffolk. On the death of her husband, the Romans seized the whole of his property. She claimed a share, and was beaten for her pains. Gathering a large army of her indignant people, she burned many Roman towns, massacring 70,000 people. She was defeated by Suetonius Paulinus, and poisoned herself to avoid being taken prisoner, A.D. 61.

Agricola.—Appointed Governor of Britain by Vespasian (78-85). Completed the conquest of the island, advancing as far north as the Moray Frith. Built an earthen wall from the Tyne to the Solway, and a chain of forts from the Forth to the Clyde. In 85 he defeated Galgacus at the foot of the Grampians. His fleet circumnavigated the island. Tacitus, his son-in-law, records his history.

Augustine.—Sent by Pope Gregory from Rome to convert Britain (597). Received kindly by Ethelbert, and allowed to teach and preach. Became first Archbishop of Canterbury, and founded see of Rochester.

Dunstan.—Favourite of Edred (946-955), over whom he exercised great power. Abbot of Glastonbury. By great austerity of life obtained reputation for sanctity. Increased the power of the clergy, founded a new order of Benedictine monks, and enforced the celibacy of the clergy. Fled to Ghent on being called to account by Edwy, but returned with an army of Danes. Made archbishop by Edgar; died in 988.

Edric the Traitor.—King of Mercia; proved false to Saxon cause during quarrel between Edmund Ironside and Danes. Edmund was murdered through his contrivance, 1016.

Godwin.—Earl of Kent, and most powerful English noble in reign of Edward the Confessor, his sons ruling Wessex, East Anglia, and Essex. Rebelled, owing to quarrel with Edward's French favourites, but driven into exile, 1015. Returned with fleet, and restored to honours, but died shortly afterwards. His name is still retained in Goodwin Sands.

(To be continued.)

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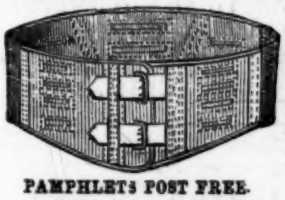

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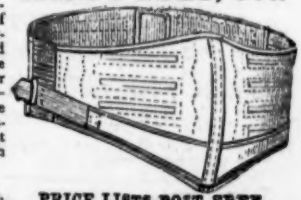

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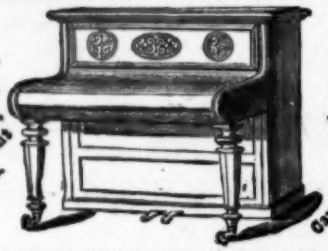
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